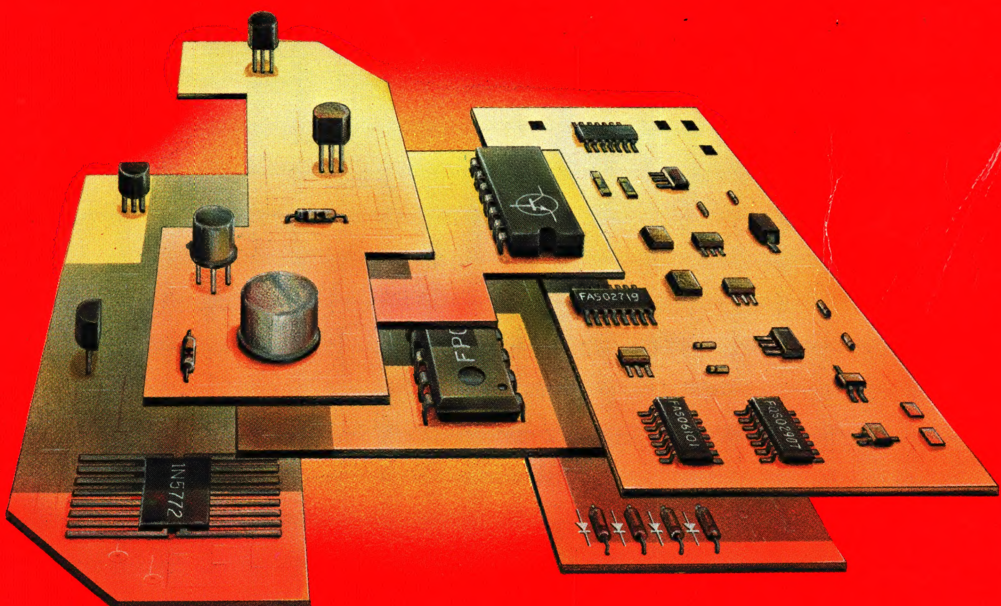
FAIRCHILD
A Schlumberger Company

Discrete Data Book

1985

Analog Division



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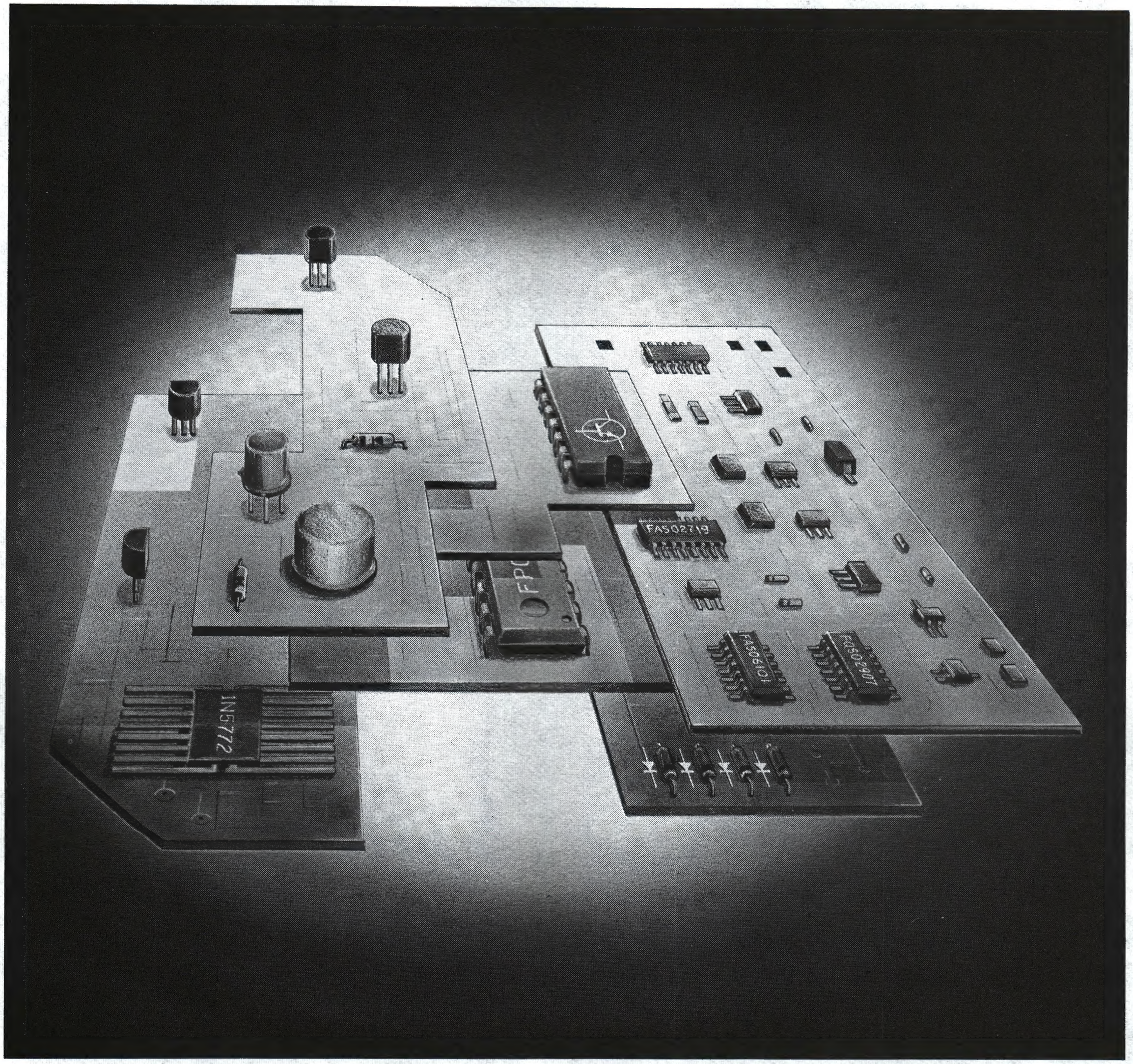

Analog Division, Discrete Small Signal Products
4300 Redwood Highway, San Rafael, Ca 94903
(415) 479-8000 TWX: DISC.SRAF

Introduction

The Discrete Small Signal Division, located in San Rafael, manufactures a broad line of discrete semiconductor products.

They include:

- Small signal and computer diodes in hermetic glass packages.
- General purpose, switching and power transistors in both plastic and hermetic metal can packages.
- Monolithic diode arrays in plastic and ceramic packages.
- Plastic quad transistor arrays.
- Plastic phototransistors.
- Many of the above devices are also available in surface mount packages.
  - Leadless glass diodes
  - SOT diodes and transistors
  - SOIC arrays
- Transistor, diode and monolithic array die
  - Hi-reliability qualified die (waffle pack)
  - Tested die in wafer form

These products are designed to fill the needs of a wide range of consumer, industrial, computer and telecommuications applications. Also available are additionally processed high reliability and special selection devices.

The selection guides in this book are designed to provide an easy reference to the many standard device types currently offered by Fairchild. If your needs are not satisfied by any of the devices offered, please consult your local Fairchild sales representative or the factory, as special selections are available.

Fairchild has been a major supplier in this market for many years and the quality of product, high volume - on-time delivery and customer service is outstanding.

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1N766	1N5243A	3-213	2-17
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1N772	1N4448	3-201	2-3
1N772A	FDH444	3-53	2-6
1N773	1N4448	3-201	2-3
1N773A	FDH444	3-53	2-6
1N774	1N4448	3-201	2-3
1N774A	FDH444	3-53	2-6
1N775	1N4448	3-201	2-3
1N776	1N4448	3-201	2-3
1N777	1N4448	3-201	2-3
1N778	1N4148	3-201	2-3
1N779	1N3070	3-205	2-6
1N781	1N4305	3-204	2-3
1N781A	1N4305	3-204	2-3
1N788	1N4448	3-201	2-3
1N789	1N4148	3-201	2-3
1N789M	1N4148	3-201	2-3
1N790	1N4148	3-201	2-3
1N790M	1N4148	3-201	2-3
1N791	1N4448	3-201	2-3
1N791M	1N4448	3-201	2-3
1N792	1N4448	3-201	2-3
1N792M	1N4448	3-201	2-3
1N793	1N4148	3-201	2-3
1N793M	1N4148	3-201	2-3
1N794	1N4148	3-201	2-3
1N795	1N4448	3-201	2-3
1N796	1N4448	3-201	2-3
1N797	1N3070	3-205	2-6
1N798	1N3070	3-205	2-6
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1N801	1N3070	3-205	2-6
1N802	1N3070	3-205	2-6
1N803	1N3070	3-205	2-6
1N804	1N3070	3-205	2-6
1N805	1N4148	3-201	2-3
1N806	1N4148	3-201	2-3
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1N808	1N4448	3-201	2-3

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1N812M	1N4149	3-201	2-3
1N813	1N4148	3-201	2-3
1N813M	1N4148	3-201	2-3
1N814	1N4148	3-201	2-3
1N814M	1N4148	3-201	2-3
1N815	1N4448	3-201	2-3
1N815M	1N4448	3-201	2-3
1N817	1N3070	3-205	2-6
1N818	1N4148	3-201	2-3
1N81A	1N4148	3-201	2-3
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1N838	1N3070	3-205	2-6
1N839	1N3070	3-205	2-6
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1N842	1N3070	3-205	2-6
1N843	1N3070	3-205	2-6
1N844	1N3070	3-205	2-6
1N845	1N3070	3-205	2-6
1N890	1N4447	3-201	2-3
1N891	1N4448	3-201	2-3
1N892	1N4448	3-201	2-3
1N893	1N3070	3-205	2-6
1N897	1N4148	3-201	2-3
1N898	1N4448	3-201	2-3
1N899	1N3070	3-205	2-6
1N900	1N3070	3-205	2-6
1N901	1N3070	3-205	2-6
1N902	1N3070	3-205	2-6
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1N907A	1N4448	3-201	2-3
1N907AM	1N4447	3-201	2-3
1N907M	1N4149	3-201	2-3
1N908	1N4149	3-201	2-3
1N908A	1N4447	3-201	2-3
1N908AM	1N4447	3-201	2-3
1N908M	1N4149	3-201	2-3
1N909	1N4449	3-201	2-3
1N910	1N4449	3-201	2-3
1N911	1N4449	3-201	2-3
1N914	1N914	3-201	2-3
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1N914B	1N914B	3-201	2-3
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1N925	1N4148	3-201	2-3
1N926	1N4148	3-201	2-3
1N927	1N4148	3-201	2-3
1N928	1N3070	3-205	2-6
1N930	1N4446	3-201	2-3
1N931	1N3070	3-205	2-6
1N932	1N3070	3-205	2-6
1N933	1N3070	3-205	2-6
1N934	1N3070	3-205	2-6
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1N958A	1N958A	3-203	2-16
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1N962	1N962	3-203	2-17
1N962A	1N962A	3-203	2-17
1N962B	1N962B	3-203	2-17
1N963	1N963	3-203	2-17
1N963A	1N963A	3-203	2-17
1N963B	1N963B	3-203	2-17
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1N964A	1N964A	3-203	2-17
1N964B	1N964B	3-203	2-17
1N965	1N965	3-203	2-17
1N965A	1N965A	3-203	2-17
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1N966A	1N966A	3-203	2-17
1N966B	1N966B	3-203	2-17
1N967	1N967	3-203	2-18
1N967A	1N967A	3-203	2-18
1N967B	1N967B	3-203	2-18
1N968	1N968	3-203	2-18
1N968A	1N968A	3-203	2-18
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1N969A	1N969A	3-203	2-18
1N969B	1N969B	3-203	2-18
1N970	1N970	3-203	2-18
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1N970B	1N970B	3-203	2-18
1N971	1N971	3-203	2-18
1N971A	1N971A	3-203	2-18
1N971B	1N971B	3-203	2-18
1N972	1N972	3-203	2-18
1N972A	1N972A	3-203	2-18
1N972B	1N972B	3-203	2-18
1N973	1N973	3-203	2-18
1N973A	1N973A	3-203	2-18
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1N997	1N4148	3-201	2-3
1N998	1N484B	3-196	2-5
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1N1509	1N4734	3-211	2-16
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1N1770	1N4739	3-211	2-17
1N1770A	1N4739A	3-211	2-17
1N1771	1N4740	3-211	2-17
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1N1772	1N4741	3-211	2-17
1N1772A	1N4741A	3-211	2-17
1N1773	1N4742	3-211	2-17
1N1773A	1N4742A	3-211	2-17
1N1775	1N4744	3-211	2-17
1N1775A	1N4744A	3-211	2-17
1N1776	1N4745	3-211	2-17
1N1776A	1N4745A	3-211	2-17
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1N1778	1N4747	3-211	2-18
1N1778A	1N4747A	3-211	2-18
1N1779	1N4748	3-211	2-18
1N1779A	1N4748A	3-211	2-18
1N1780	1N4749	3-211	2-18
1N1780A	1N4749A	3-211	2-18
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1N1960	1N5242A	3-213	2-17
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1N1962	1N5248A	3-213	2-18
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1N2040	1N4749	3-211	2-18
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1N3017	1N4737	3-211	2-17
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1N3023A	1N4743	3-211	2-17
1N3023B	1N4743A	3-211	2-17
1N3024	1N4744	3-211	2-17
1N3024A	1N4744	3-211	2-17
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1N3025	1N4745	3-211	2-17
1N3025A	1N4745	3-211	2-17
1N3025B	1N4745A	3-211	2-17
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1N3026A	1N4746	3-211	2-18
1N3026B	1N4746A	3-211	2-18
1N3027	1N4747	3-211	2-18
1N3027A	1N4747	3-211	2-18
1N3027B	1N4747A	3-211	2-18
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1N3028A	1N4748	3-211	2-18
1N3028B	1N4748A	3-211	2-18
1N3029	1N4749	3-211	2-18
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1N3030A	1N4750	3-211	2-18
1N3030B	1N4750A	3-211	2-18
1N3031	1N4751	3-211	2-18
1N3031A	1N4751	3-211	2-18
1N3031B	1N4751A	3-211	2-18
1N3032	1N4752	3-211	2-18
1N3032A	1N4752	3-211	2-18
1N3032B	1N4752A	3-211	2-18
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1N3063	1N4305	3-204	2-3
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1N3065	1N4305	3-204	2-3
1N3066	1N4305	3-204	2-3
1N3067	1N4148	3-201	2-3
1N3068	1N4148	3-201	2-3
1N3069	1N4148	3-201	2-3
1N3070	1N3070	3-205	2-6
1N3071	1N3070	3-205	2-6
1N3097	1N4305	3-204	2-3
1N3110	1N4305	3-204	2-3
1N3121	1N4305	3-204	2-3
1N3122	1N4305	3-204	2-3
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1N3180	1N3070	3-205	2-6
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1N3206	1N4148	3-201	2-3
1N3215	1N4152	3-209	2-3
1N3223	1N3070	3-205	2-6
1N3225	1N4148	3-201	2-3
1N3257	1N4449	3-201	2-3
1N3258	1N4448	3-201	2-3
1N3298	FDH400	3-53	2-6
1N3298A	FDH400	3-53	2-6
1N3465	FDH444	3-53	2-6
1N3466	FDH444	3-53	2-6
1N3467	1N4446	3-201	2-3
1N3468	1N4446	3-201	2-3
1N3469	FDH400	3-53	2-6
1N3470	FDH400	3-53	2-6
1N3471	1N4148	3-201	2-3
1N3483	1N4305	3-204	2-3
1N3484	1N4305	3-204	2-3
1N3485	1N3070	3-205	2-6
1N3535	1N3070	3-205	2-6
1N3536	1N457	3-194	—
1N3550	1N3070	3-205	2-6
1N3559	FDH444	3-53	2-6
1N3564	1N4448	3-201	2-3
1N3567	1N4448	3-201	2-3
1N3568	1N4449	3-201	2-3
1N3575	1N483B	3-196	2-5
1N3576	1N484B	3-196	2-5
1N3592	1N4305	3-204	2-3
1N3593	1N4148	3-201	2-3
1N3594	FDH600	3-54	2-3
1N3595	1N3595	3-206	2-5
1N3596	1N4449	3-201	2-3
1N3597	1N3070	3-205	2-6
1N3598	1N4152	3-209	2-3
1N3599	1N4938	3-205	2-6
1N3600	1N3600	3-207	2-7
1N3601	1N4149	3-201	2-3
1N3602	1N4151	3-209	2-3
1N3603	1N4151	3-209	2-3
1N3604	1N4151	3-209	2-3
1N3605	1N4152	3-209	2-3
1N3606	1N4153	3-209	2-3
1N3607	1N4151	3-209	2-3
1N3608	1N4152	3-209	2-3
1N3609	1N4153	3-209	2-3
1N3625	1N3070	3-205	2-6
1N3638B	1N4744A	3-211	2-17
1N3653	FDH400	3-53	2-6
1N3654	1N4448	3-201	2-3
1N3666	1N4305	3-204	2-3
1N3668	1N4305	3-204	2-3
1N3675	1N4736	3-211	2-16
1N3675A	1N4736	3-211	2-16
1N3675B	1N4736A	3-211	2-16
1N3676	1N4737	3-211	2-17
1N3676A	1N4737	3-211	2-17
1N3676B	1N4737A	3-211	2-17
1N3677	1N4738	3-211	2-17
1N3677A	1N4738	3-211	2-17
1N3677B	1N4738A	3-211	2-17
1N3678	1N4739	3-211	2-17
1N3678A	1N4739	3-211	2-17
1N3678B	1N4739A	3-211	2-17
1N3679	1N4740	3-211	2-17
1N3679A	1N4740	3-211	2-17
1N3679B	1N4740A	3-211	2-17
1N3680	1N4741	3-211	2-17
1N3680A	1N4741	3-211	2-17
1N3680B	1N4741A	3-211	2-17
1N3681	1N4742	3-211	2-17
1N3681A	1N4742	3-211	2-17
1N3681B	1N4742A	3-211	2-17
1N3682	1N4743	3-211	2-17
1N3682A	1N4743	3-211	2-17
1N3682B	1N4743A	3-211	2-17
1N3683	1N4744	3-211	2-17
1N3683A	1N4744	3-211	2-17
1N3684	1N4745	3-211	2-17
1N3684A	1N4745	3-211	2-17
1N3684B	1N4745A	3-211	2-17
1N3685	1N4746	3-211	2-18
1N3685A	1N4746	3-211	2-18
1N3685B	1N4746A	3-211	2-18
1N3686	1N4747	3-211	2-18
1N3686A	1N4747	3-211	2-18
1N3686B	1N4747A	3-211	2-18
1N3687	1N4748	3-211	2-18
1N3687A	1N4748	3-211	2-18
1N3687B	1N4748A	3-211	2-18
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1N3689B	1N4750A	3-211	2-18
1N3690	1N4751	3-211	2-18
1N3690A	1N4751	3-211	2-18
1N3690B	1N4751A	3-211	2-18
1N3691	1N4752	3-211	2-18
1N3691A	1N4752	3-211	2-18
1N3691B	1N4752A	3-211	2-18
1N3722	1N4148	3-201	2-3
1N3731	1N4153	3-209	2-3
1N3753	1N4148	3-201	2-3
1N3769	1N4305	3-204	2-3
1N3773	1N4305	3-204	2-3
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1N3824A	1N4731A	3-211	2-16
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1N3827A	1N4734A	3-211	2-16
1N3828	1N4735	3-211	2-16
1N3828A	1N4735A	3-211	2-16
1N3929	1N4736	3-211	2-16
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1N3830A	1N4737A	3-211	2-17
1N3864	1N458	3-194	2-5
1N3865	1N4148	3-201	2-3
1N3872	FDH444	3-53	2-6
1N3873	FDH444	3-53	2-6
1N3944	1N4305	3-204	2-3
1N3952	1N3070	3-205	2-6
1N3953	1N4148	3-201	2-3
1N3954	1N4150	3-207	2-3
1N3956	1N4305	3-204	2-3
1N3991	1N4305	3-204	2-3
1N4008	1N4305	3-204	2-3
1N4009	1N4009	3-208	2-4
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1N4147B	1N4752A	3-211	2-18
1N4148	1N4148	3-201	2-3
1N4149	1N4149	3-201	2-3
1N4150	1N4150	3-207	2-3
1N4151	1N4151	3-209	2-3
1N4152	1N4152	3-209	2-3
1N4153	1N4153	3-209	2-3
1N4154	1N4154	3-209	2-3
1N4158	1N4736	3-211	2-16
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1N4161	1N4739	3-211	2-17
1N4161A	1N4739	3-211	2-17
1N4161B	1N4739A	3-211	2-17
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1N4162A	1N4740	3-211	2-17
1N4162B	1N4740A	3-211	2-17
1N4163	1N4741	3-211	2-17
1N4163A	1N4741	3-211	2-17
1N4163B	1N4741A	3-211	2-17
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1N4164A	1N4742	3-211	2-17
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1N4165A	1N4743	3-211	2-17
1N4165B	1N4743A	3-211	2-17
1N4166	1N4744	3-211	2-17
1N4166A	1N4744	3-211	2-17
1N4166B	1N4744A	3-211	2-17
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1N4167A	1N4745	3-211	2-17
1N4167B	1N4745A	3-211	2-17
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1N4168A	1N4746	3-211	2-18
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1N4169	1N4747	3-211	2-18
1N4169A	1N4747	3-211	2-18
1N4169B	1N4747A	3-211	2-18
1N4170	1N4748	3-211	2-18
1N4170A	1N4748	3-211	2-18
1N4170B	1N4748A	3-211	2-18
1N4171	1N4749	3-211	2-18
1N4171A	1N4749	3-211	2-18
1N4171B	1N4749A	3-211	2-18
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1N4173B	1N4751A	3-211	2-18
1N4242	FDH900	3-56	2-4
1N4243	FDH900	3-56	2-4
1N4244	1N4244	3-18	2-3
1N4254	1N4305	3-204	2-3
1N4305	1N4305	3-204	2-3
1N4306	1N4306	3-210	—
1N4307	1N4307	3-210	—
1N4308	1N4150	3-207	2-3
1N4309	FDH400	3-53	2-6
1N4310	FDH400	3-53	2-6
1N4312	FDH444	3-53	2-6
1N4313	1N4151	3-209	2-3
1N4314	1N4150	3-207	2-3
1N4315	FDH400	3-53	2-6
1N4316	FDH400	3-53	2-6
1N4318	FDH444	3-53	2-6
1N4319	1N4151	3-209	2-3
1N4322	1N4150	3-207	2-3
1N4323	1N4736	3-211	2-16
1N4323B	1N4736A	3-211	2-16
1N4324	1N4737	3-211	2-17
1N4324A	1N4737	3-211	2-17
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1N4325	1N4738	3-211	2-17
1N4325A	1N4738	3-211	2-17
1N4325B	1N4738A	3-211	2-17
1N4326	1N4739	3-211	2-17
1N4326A	1N4739	3-211	2-17
1N4326B	1N4739A	3-211	2-17
1N4327	1N4740	3-211	2-17
1N4327A	1N4740	3-211	2-17
1N4327B	1N4740A	3-211	2-17
1N4328	1N4741	3-211	2-17
1N4328A	1N4741	3-211	2-17
1N4328B	1N4741A	3-211	2-17
1N4329	1N4742	3-211	2-17
1N4329A	1N4742	3-211	2-17
1N4329B	1N4742A	3-211	2-17
1N4330	1N4743	3-211	2-17
1N4330A	1N4743	3-211	2-17
1N4330B	1N4743A	3-211	2-17
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1N4333A	1N4746	3-211	2-18
1N4333B	1N4746A	3-211	2-18
1N4334	1N4747	3-211	2-18
1N4334A	1N4747	3-211	2-18
1N4334B	1N4747A	3-211	2-18
1N4335	1N4748	3-211	2-18
1N4335A	1N4748	3-211	2-18
1N4335B	1N4748A	3-211	2-18
1N4336	1N4749	3-211	2-18
1N4336A	1N4749	3-211	2-18
1N4336B	1N4749A	3-211	2-18
1N4337	1N4750	3-211	2-18
1N4337A	1N4750	3-211	2-18
1N4337B	1N4750A	3-211	2-18
1N4338	1N4751	3-211	2-18
1N4338A	1N4751	3-211	2-18
1N4338B	1N4751A	3-211	2-18
1N4339	1N4752	3-211	2-18
1N4339A	1N4752	3-211	2-18
1N4339B	1N4752A	3-211	2-18
1N4362	1N484B	3-196	2-5
1N4363	1N3070	3-205	2-6
1N4373	1N4148	3-201	2-3
1N4375	1N4153	3-209	2-3
1N4376	1N4376	3-18	2-3
1N4389	1N4148	3-201	2-3
1N4390	FD700	3-55	2-3
1N4391	FD700	3-55	2-3
1N4392	FD700	3-55	2-3
1N4400	1N4736	3-211	2-16
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1N4403	1N4739	3-211	2-17
1N4404	1N4740	3-211	2-17
1N4405	1N4741	3-211	2-17
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1N4411	1N4747	3-211	2-18
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1N4413	1N4749	3-211	2-18
1N4414	1N4750	3-211	2-18
1N4415	1N4751	3-211	2-18
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1N4446	1N4446	3-201	2-3
1N4447	1N4447	3-201	2-3
1N4448	1N4448	3-201	2-3
1N4449	1N4449	3-201	2-3
1N4450	1N4450	3-207	2-4
1N4451	1N4151	3-209	2-3
1N4453	1N4448	3-201	2-3
1N4454	1N4454	3-204	2-3
1N4455	1N4305	3-204	2-3
1N4456	1N4150	3-207	2-3
1N4457	1N4150	3-207	2-3
1N4502	1N4305	3-204	2-3
1N4523	1N4305	3-204	2-3
1N4531	1N4148	3-201	2-3
1N4532	FDH600	3-54	2-3
1N4533	1N4152	3-209	2-3
1N4534	1N4153	3-209	2-3
1N4536	1N4154	3-209	2-3
1N4547	1N4151	3-209	2-3
1N4548	1N4154	3-209	2-3
1N4608	FDH400	3-53	2-6
1N4610	1N4150	3-207	2-3
1N4628	1N4736A	3-211	2-16
1N4629	1N4737A	3-211	2-17
1N4630	1N4738A	3-211	2-17
1N4631	1N4739A	3-211	2-17
1N4632	1N4740A	3-211	2-17
1N4633	1N4741A	3-211	2-17
1N4634	1N4742A	3-211	2-17
1N4635	1N4743A	3-211	2-17
1N4636	1N4744A	3-211	2-17
1N4637	1N4745A	3-211	2-17
1N4638	1N4746A	3-211	2-18
1N4639	1N4747A	3-211	2-18
1N4640	1N4748A	3-211	2-18
1N4641	1N4749A	3-211	2-18
1N4642	1N4750A	3-211	2-18
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1N4644	1N4752A	3-211	2-18
1N4649	1N4728A	3-211	2-16
1N4650	1N4729A	3-211	2-16
1N4651	1N4730A	3-211	2-16
1N4652	1N4731A	3-211	2-16
1N4653	1N4732A	3-211	2-16
1N4654	1N4733A	3-211	2-16
1N4655	1N4734A	3-211	2-16
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1N4661	1N4740A	3-211	2-17
1N4662	1N4741A	3-211	2-17
1N4663	1N4742A	3-211	2-17
1N4664	1N4743A	3-211	2-17
1N4665	1N4744A	3-211	2-17
1N4666	1N4745A	3-211	2-17
1N4667	1N4746A	3-211	2-18
1N4668	1N4747A	3-211	2-18
1N4669	1N4748A	3-211	2-18
1N4670	1N4749A	3-211	2-18
1N4671	1N4750A	3-211	2-18
1N4672	1N4751A	3-211	2-18
1N4673	1N4752A	3-211	2-18
1N4728	1N4728	3-211	2-16
1N4728A	1N4728A	3-211	2-16
1N4729	1N4729	3-211	2-16
1N4729A	1N4729A	3-211	2-16
1N4730	1N4730	3-211	2-16
1N4730A	1N4730A	3-211	2-16
1N4731	1N4731	3-211	2-16
1N4731A	1N4731A	3-211	2-16
1N4732	1N4732	3-211	2-16
1N4732A	1N4732A	3-211	2-16
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1N4733A	1N4733A	3-211	2-16
1N4734	1N4734	3-211	2-16
1N4734A	1N4734A	3-211	2-16
1N4735	1N4735	3-211	2-16
1N4735A	1N4735A	3-211	2-16
1N4736	1N4736	3-211	2-16
1N4736A	1N4736A	3-211	2-16
1N4737	1N4737	3-211	2-17
1N4737A	1N4737A	3-211	2-17
1N4738	1N4738	3-211	2-17
1N4738A	1N4738A	3-211	2-17
1N4739	1N4739	3-211	2-17
1N4739A	1N4739A	3-211	2-17
1N4740	1N4740	3-211	2-17
1N4740A	1N4740A	3-211	2-17
1N4741	1N4741	3-211	2-17
1N4741A	1N4741A	3-211	2-17
1N4742	1N4742	3-211	2-17
1N4742A	1N4742A	3-211	2-17
1N4743	1N4743	3-211	2-17
1N4743A	1N4743A	3-211	2-17
1N4744	1N4744	3-211	2-17
1N4744A	1N4744A	3-211	2-17

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1N4747	1N4747	3-211	2-18
1N4747A	1N4747A	3-211	2-18
1N4748	1N4748	3-211	2-18
1N4748A	1N4748A	3-211	2-18
1N4749	1N4749	3-211	2-18
1N4749A	1N4749A	3-211	2-18
1N4750	1N4750	3-211	2-18
1N4750A	1N4750A	3-211	2-18
1N4751	1N4751	3-211	2-18
1N4751A	1N4751A	3-211	2-18
1N4827	1N4448	3-201	2-3
1N4828	FDH444	3-53	2-6
1N4829	FDH444	3-53	2-6
1N4830	FDH444	3-53	2-6
1N4861	1N457	3-194	—
1N4862	1N457	3-194	—
1N4863	1N4148	3-201	2-3
1N4864	1N4151	3-209	2-3
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1N4938	1N3070	3-205	2-6
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1N5227	1N5227	3-213	2-16
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1N5564B	1N4741A	3-211	2-17
1N5565	1N4742	3-211	2-17
1N5565A	1N4742	3-211	2-17
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1N5926B	1N4741A	3-211	2-17
1N5927	1N4742	3-211	2-17
1N5927A	1N4742	3-211	2-17
1N5927B	1N4742A	3-211	2-17
1N5928	1N4743	3-211	2-17
1N5928A	1N4743	3-211	2-17
1N5928B	1N4743A	3-211	2-17
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2N336A	2N2218	3-236	2-34
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2N476	2N2221	3-236	2-34
2N477	2N2221	3-236	2-34
2N478	2N2221	3-236	2-34
2N479	2N2221	3-236	2-34
2N479A	2N2221	3-236	2-34
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2N480A	2N2221	3-236	2-34
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2N541A	2N2221	3-236	2-34
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2N543	2N2221	3-236	2-34
2N543A	2N2221	3-236	2-34
2N551	2N1893	3-234	2-28
2N552	2N2218	3-236	2-34
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2N620	2N2221	3-236	2-34
2N621	2N2221	3-236	2-34
2N696A	2N2218	3-236	2-34
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2N699B	2N1893	3-234	2-28
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2N703	2N3946	3-282	2-32
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2N706C	2N2369	3-246	2-24
2N709	2N2369A	3-246	2-24
2N715	2N2221	3-236	2-34
2N716	2N2221	3-236	2-34
2N718A	2N718A	3-224	2-38
2N721A	2N2906	3-258	2-42
2N722A	2N2906	3-258	2-42
2N730	2N2218	3-236	2-34
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2N735	2N2484	3-251	2-28
2N735A	2N2484	3-251	2-28
2N736	2N2484	3-251	2-28
2N736A	2N2484	3-251	2-28
2N736B	2N2484	3-251	2-28
2N742	2N2484	3-251	2-28
2N742A	2N2484	3-251	2-28
2N744A	2N2369A	3-246	2-24
2N745	2N2221	3-236	2-34
2N746	2N2221	3-236	2-34
2N747	2N2221	3-236	2-34
2N748	2N2221	3-236	2-34
2N749	2N2221	3-236	2-34
2N751	2N2221	3-236	2-34
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2N757A	2N2484	3-251	2-28
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2N758A	2N2484	3-251	2-28
2N758B	2N2484	3-251	2-28
2N759	2N930	3-226	2-30
2N759A	2N2484	3-251	2-28
2N759B	2N2484	3-251	2-28
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2N762	2N930	3-226	2-30
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2N771	2N3013	3-262	2-24
2N772	2N3013	3-262	2-24
2N773	2N3013	3-262	2-24
2N774	2N3013	3-262	2-24
2N775	2N3013	3-262	2-24
2N776	2N3013	3-262	2-24
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2N790	2N3946	3-282	2-32
2N791	2N3946	3-282	2-32
2N792	2N3946	3-282	2-32
2N793	2N3946	3-282	2-32
2N834A	2N2369A	3-246	2-24
2N839	2N3946	3-282	2-32
2N840	2N3946	3-282	2-32
2N842	2N3946	3-282	2-32
2N843	2N3946	3-282	2-32
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2N850	2N2369A	3-246	2-24
2N852	2N2369A	3-246	2-24
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2N859	2N2906	3-258	2-42
2N860	2N2906	3-258	2-42
2N861	2N2906	3-258	2-42
2N862	2N2906	3-258	2-42
2N863	2N2906	3-258	2-42
2N864	2N2906	3-258	2-42
2N864A	2N2906	3-258	2-42
2N865	2N2906	3-258	2-42
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2N904	2N2221	3-236	2-34
2N905	2N2221	3-236	2-34
2N906	2N2221	3-236	2-34
2N907	2N2221	3-236	2-34
2N908	2N2221	3-236	2-34
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2N918	PN918	3-134	2-22
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2N925	2N2906	3-258	2-42
2N926	2N2906	3-258	2-42
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2N938	2N2906	3-258	2-42
2N939	2N2906	3-258	2-42
2N940	2N2906	3-258	2-42
2N941	2N2906	3-258	2-42
2N942	2N2906	3-258	2-42
2N943	2N2906	3-258	2-42
2N944	2N2906	3-258	2-42
2N945	2N2906	3-258	2-42
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2N989	2N2221	3-236	2-34
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2N1074	2N2218	3-236	2-34
2N1075	2N2218	3-236	2-34
2N1076	2N2218	3-236	2-34
2N1077	2N2218	3-236	2-34
2N1081	2N2221	3-236	2-34
2N1082	2N2221	3-236	2-34
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2N1151	2N2221A	3-238	2-32
2N1152	2N2221A	3-238	2-32
2N1153	2N2221A	3-238	2-32
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2N1231	2N2904	3-258	2-42
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2N1337	2N2218A	3-238	2-32
2N1338	2N2218A	3-238	2-32
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2N1340	2N1893	3-234	2-28
2N1341	2N1893	3-234	2-28
2N1342	2N1893	3-234	2-28
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2N1387	2N2222	3-240	2-34
2N1388	2N2222	3-240	2-34
2N1389	2N2222A	3-242	2-32
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2N1474A	2N2906A	3-260	2-44
2N1475	2N2906A	3-260	2-44
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2N1506	2N2218	3-236	2-34
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2N1565	2N1893	3-234	2-28
2N1566	2N1893	3-234	2-28
2N1566A	2N1893	3-234	2-28
2N1572	2N1893	3-234	2-28
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2N1591	2N3946	3-282	2-32
2N1592	2N3946	3-282	2-32
2N1593	2N3946	3-282	2-32
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2N1613	2N1613	3-224	2-32
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2N1613B	2N3020	3-264	2-28
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2N1704	2N2218	3-236	2-34
2N1708	2N3013	3-262	2-24
2N1708A	2N3013	3-262	2-24
2N1711A	2N2219A	3-242	2-32
2N1711B	2N2219A	3-242	2-32
2N1764	2N2369A	3-246	2-24
2N1837	2N2218	3-236	2-34
2N1837A	2N2218	3-236	2-34
2N1837B	2N2218	3-236	2-34
2N1838	2N2218	3-236	2-34
2N1840	2N2218	3-236	2-34
2N1890	2N1890	3-232	2-28
2N1893	2N1893	3-234	2-28
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2N1941	2N2218	3-236	2-34
2N1943	2N3020	3-264	2-28
2N1944	2N2219	3-240	2-34
2N1945	2N2219	3-240	2-34
2N1946	2N2219A	3-242	2-32
2N1953	2N2218	3-236	2-34
2N1958	2N3724	3-276	2-22
2N1958A	2N3724	3-276	2-22
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2N1959A	2N3724	3-276	2-22
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2N2218	2N2218	3-236	2-34
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2N2219	2N2219	3-240	2-34
2N2219A	2N2219A	3-242	2-32
2N2220	2N2221	3-236	2-34
2N2221	2N2221	3-236	2-34
2N2221A	2N2221A	3-238	2-32
2N2222	2N2222	3-240	2-34
2N2222A	2N2222A	3-242	2-32
2N2222B	2N2222A	3-242	2-32
2N2236	2N2218	3-236	2-34
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2N2616	PN918	3-134	2-22
2N2618	2N2218	3-236	2-34
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2N2907	2N2907	3-258	2-42
2N2907A	2N2907A	3-260	2-44
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2N2961	2N2219	3-240	2-34
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2N3019	2N3019	3-264	2-28
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2N3056	2N3020	3-264	2-28
2N3056A	2N3020	3-264	2-28
2N3057	2N3019	3-264	2-28
2N3057A	2N3019	3-264	2-28
2N3077	2N2484	3-251	2-28
2N3081	2N3020	3-264	2-28
2N3107	2N3107	3-267	2-28
2N3108	2N3108	3-267	2-28
2N3109	2N3109	3-267	2-28
2N3117	2N3117	3-251	2-28
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2N3123	2N2219	3-240	2-34
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2N3211	2N3013	3-262	2-24
2N3241	2N2222	3-240	2-34
2N3241A	2N2222	3-240	2-34
2N3242	2N2222	3-240	2-34
2N3242A	2N2222	3-240	2-34
2N3246	2N2484	3-251	2-28
2N3247	2N2484	3-251	2-28
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2N3395	MPS3392	3-95	2-36
2N3396	MPS3393	3-95	2-36
2N3397	2N4123	3-291	2-34
2N3398	2N4123	3-291	2-34
2N3402	2N4124	3-291	2-36
2N3404	PN3693	3-154	2-30
2N3405	PN3694	3-154	2-30
2N3439	2N3439	3-273	2-49
2N3440	2N3440	3-273	2-49
2N3451	2N4208	3-295	2-26
2N3464	2N2219A	3-242	2-32
2N3485	2N2906	3-258	2-42
2N3485A	2N2906A	3-260	2-44
2N3486	2N2907	3-258	2-42
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2N3508	2N2369A	3-246	2-24
2N3509	2N2369A	3-246	2-24
2N3510	2N3013	3-262	2-24
2N3512	2N3724	3-276	2-22
2N3546	2N4208	3-295	2-26
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2N3548	2N3962	3-284	2-46
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2N3565	PN3565	3-137	2-36
2N3566	PN3566	3-138	2-34
2N3567	PN3567	3-140	2-32
2N3569	PN3569	3-140	2-32
2N3576	2N4209	3-295	2-26
2N3579	2N3962	3-284	2-46
2N3580	2N3962	3-284	2-46
2N3581	2N3962	3-284	2-46
2N3582	2N3962	3-284	2-46
2N3605	2N5769	3-246	2-24
2N3605A	2N5769	3-246	2-24
2N3606	2N5769	3-246	2-24
2N3606A	2N5769	3-246	2-24
2N3607	2N5769	3-246	2-24
2N3638	PN3638	3-142	2-40
2N3638A	PN3638A	3-142	2-40
2N3639	PN3639	3-144	2-26
2N3640	PN3640	3-144	2-26
2N3641	PN3641	3-147	2-34
2N3642	PN3642	3-147	2-30
2N3643	PN3643	3-147	2-34
2N3644	PN3644	3-150	2-44
2N3645	PN3645	3-150	2-44
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2N3648	2N3013	3-262	2-24
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2N3672	2N2907A	3-260	2-44
2N3673	2N2907A	3-260	2-44
2N3693	PN3693	3-154	2-30
2N3694	PN3694	3-154	2-30
2N3700	2N3700	3-274	2-28
2N3701	2N3701	3-274	2-28
2N3703	MPS3703	3-97	—
2N3724	2N3724	3-276	2-22
2N3725	2N3725	3-276	2-22
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2N3844A	2N4123	3-291	2-34
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2N3854	2N4123	3-291	2-34
2N3854A	2N4123	3-291	2-34
2N3855	2N4123	3-291	2-34
2N3855A	2N4123	3-291	2-34
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2N3877A	2N5550	3-333	2-26
2N3900	2N5210	3-313	2-30
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2N3901	2N5088	3-311	2-34
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2N3904	2N3904	3-278	2-32
2N3905	2N3905	3-280	2-42
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2N4036	2N4036	3-289	2-46
2N4037	2N4037	3-289	2-42
2N4062	MPS6518	3-103	—
2N4086	MPS6514	3-102	2-36
2N4087	MPS6514	3-102	2-36
2N4087A	MPS6515	3-102	2-36
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2N4122	PN4122	3-156	2-42
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2N4143	2N4403	3-303	2-42
2N4208	2N4208	3-295	2-26
2N4209	2N4209	3-295	2-26
2N4227	2N4400	3-301	2-32
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2N4235	2N4235	3-297	2-49
2N4236	2N4236	3-297	2-49
2N4237	2N4237	3-299	2-49
2N4238	2N4238	3-299	2-49
2N4239	2N4239	3-299	2-49
2N4248	PN4248	3-158	2-42
2N4249	PN4249	3-158	2-44
2N4250	PN4250	3-158	2-42
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2N4274	PN4274	3-163	2-24
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2N4286	MPS6515	3-102	2-36
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2N4289	2N5086	3-309	2-44
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2N4295	2N5769	3-246	2-24
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2N4401	2N4401	3-301	2-32
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2N4407	2N4033	3-286	2-46
2N4409	2N4409	3-305	2-30
2N4410	2N4410	3-305	2-28
2N4412	2N3962	3-284	2-46
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2N4419	2N5772	3-152	2-24
2N4420	2N5772	3-152	2-24
2N4421	2N5772	3-152	2-24
2N4422	2N5772	3-152	2-24
2N4423	2N5772	3-152	2-24
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2N4872	2N4208	3-295	2-26
2N4873	2N2369A	3-246	2-24
2N4888	PN4888	3-168	2-64
2N4889	PN4889	3-168	2-46
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2N4952	2N2222	3-240	2-34
2N4953	2N2222	3-240	2-34
2N4954	2N2221	3-236	2-34
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2N4969	2N4400	3-301	2-32
2N4970	2N4401	3-301	2-32
2N4971	2N4402	3-303	2-42
2N4972	2N4403	3-303	2-42
2N4994	PN3693	3-154	2-30
2N4995	PN3694	3-154	2-30
2N5026A	MPSA14	3-114	2-38
2N5055	PN4258	3-161	2-26
2N5056	2N4209	3-295	2-26
2N5057	2N4209	3-295	2-26
2N5086	2N5086	3-309	2-44
2N5087	2N5087	3-309	2-44
2N5088	2N5088	3-311	2-34
2N5089	2N5089	3-311	2-36
2N5106	2N2219	3-240	2-34
2N5107	2N2222	3-240	2-34
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2N5136	PN5136	3-179	2-36
2N5137	PN5137	3-179	2-36
2N5138	PN5138	3-182	2-40
2N5139	PN5139	3-184	2-38
2N5140	PN3639	3-144	2-26
2N5141	PN3639	3-144	2-26
2N5142	PN5142	3-186	2-38
2N5143	PN5143	3-186	2-38
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2N5209	2N5209	3-313	2-30
2N5210	2N5210	3-313	2-30
2N5220	2N5220	3-315	2-24
2N5223	2N5223	3-316	2-36
2N5224	2N5224	3-318	2-24
2N5225	2N5225	3-320	2-36
2N5226	2N5226	3-320	2-40
2N5227	2N5227	3-322	2-40
2N5228	2N5228	3-323	2-26
2N5233	2N5961	3-343	2-28
2N5234	2N5210	3-313	2-30
2N5249	2N5962	3-343	2-30
2N5249A	2N5962	3-343	2-30
2N5308A	MPSA14	3-114	2-38
2N5309	2N5209	3-313	2-30
2N5310	2N5209	3-313	2-30
2N5311	2N5210	3-313	2-30
2N5320	2N5320	3-325	2-49
2N5323	2N5323	3-325	2-49
2N5336	2N5336	3-327	2-49
2N5354	MPS3638	3-142	—
2N5355	MPS3638A	3-142	—
2N5365	MPS3638	3-142	—
2N5368	2N4400	3-301	2-32
2N5369	2N4401	3-301	2-32
2N5371	2N4400	3-301	2-32
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2N5375	2N4402	3-303	2-42
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2N5401	2N5401	3-329	2-46
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2N5416	2N5416	3-331	2-49
2N5418	2N4400	3-301	2-32
2N5419	2N4401	3-301	2-32
2N5420	PN3566	3-138	2-34
2N5447	MPS3702	3-97	—
2N5448	MPS3703	3-97	—
2N5449	MPS3704	3-99	2-34
2N5450	MPS3705	3-99	2-34
2N5525	MPSA13	3-114	2-38
2N5550	2N5550	3-333	2-26
2N5551	MPS5551	3-333	2-28
2N5679	2N5679	3-335	2-49
2N5680	2N5680	3-335	2-49
2N5681	2N5681	3-335	2-49
2N5682	2N5682	3-335	2-49
2N5763	2N2907A	3-260	2-44
2N5769	2N5769	3-246	2-24
2N5771	2N5771	3-338	2-26
2N5772	2N5772	3-152	2-24
2N5810	MPS6561	3-107	2-36
2N5814	2N3903	3-278	2-32
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2N5816	2N3904	3-278	2-32
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2N5819	2N3906	3-280	2-42
2N5821	PN5855	3-190	2-44
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2N5826	MPS6514	3-102	2-36
2N5827	MPS6515	3-102	2-36
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2N5830	2N5830	3-340	2-28
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2N5833	2N5833	3-340	2-26
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2N5857	PN5857	3-190	—
2N5859	2N3724	3-276	2-22
2N5860	2N3724	3-276	2-22
2N5861	2N3725	3-276	2-22
2N5864	2N4031	3-286	2-46
2N5865	2N4030	3-286	2-46
2N5961	2N5961	3-343	2-28
2N5962	2N5962	3-343	2-30
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2N5998	2N5961	3-343	2-28
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2N6009	2N5087	3-309	2-44
2N6010	2N4401	3-301	2-32
2N6011	2N4402	3-303	2-42
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2N6224	2N5962	3-343	2-30
2N6225	PN4250A	3-158	2-44
2N6515	MPS6515	3-102	2-36
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A5T2222	PN2222	3-240	2-34
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A5T2604	PN4248	3-158	2-42
A5T2605	PN4249	3-158	2-44
A5T2907	PN2907	3-258	2-42
A5T3391	2N5961	3-343	2-28
A5T3391A	2N5961	3-343	2-28
A5T3392	MPS3392	3-95	2-36
A5T3504	PN3644	3-150	2-44
A5T3505	PN3645	3-150	2-44
A5T3565	PN3565	3-137	2-36
A5T3638	MPS3638	3-142	—
A5T3638A	MPS3638A	3-142	—
A5T3644	PN3644	3-150	2-44
A5T3645	PN3645	3-150	2-44
A5T3903	2N3903	3-278	2-32
A5T3904	2N3904	3-278	2-32
A5T3905	2N3905	3-280	2-42
A5T3906	2N3906	3-280	2-42
A5T4026	PN4356	3-165	2-46
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A5T4028	PN4355	3-165	2-44
A5T4029	PN4355	3-165	2-44
A5T4058	2N5086	3-309	2-44
A5T4059	2N3905	3-280	2-42
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A5T4061	2N3906	3-280	2-42
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A5T4124	2N4124	3-291	2-36
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A5T4126	2N4126	3-293	2-40
A5T4248	PN4248	3-158	2-42
A5T4249	PN4249	3-158	2-44
A5T4250	PN4250	3-158	2-42
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A5T5087	2N5087	3-309	2-44
A5T5172	MPS5172	3-101	2-36
A5T5209	2N5209	3-313	2-30
A5T5210	2N5210	3-313	2-30
A5T5220	2N5220	3-315	2-38
A5T5223	2N5223	3-316	2-36
A5T5225	2N5225	3-320	2-36
A5T5226	2N5226	3-320	2-40
A5T5227	2N5227	3-322	2-40
A5T5400	2N5400	3-329	2-46
A5T5401	2N5401	3-329	2-46
A5T5550	2N5550	3-333	2-26
A5T5551	MPS5551	3-333	2-28
A7T3391	2N5961	3-343	2-28
A7T3391A	2N5961	3-343	2-28
A7T3392	MPS3392	3-95	2-36
A7T5172	MPS5172	3-101	2-36
A8T3391	2N5961	3-343	2-28
A8T3391A	2N5961	3-343	2-28
A8T3392	MPS3392	3-95	2-36
A8T3702	MPS3702	3-97	—
A8T3703	MPS3703	3-97	—
A8T3704	MPS3704	3-99	2-34
A8T3705	MPS3705	3-99	2-34
A8T4026	PN4356	3-165	2-46
A8T4027	PN4356	3-165	2-46
A8T4028	PN4355	3-165	2-44
A8T4029	PN4355	3-165	2-44
A8T4058	2N5086	3-309	2-44
A8T4059	2N3905	3-280	2-42
A8T4060	2N3905	3-280	2-42
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AA112	FDH999	3-56	2-8
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AA114	BA130	3-3	2-8
AA116	BA130	3-3	2-8
AA129	BA130	3-3	2-8
AA131	FDH900	3-56	2-4
AA137	BA130	3-3	2-8
AA138	BA130	3-3	2-8
AA139	BA129	3-16	2-8
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AAY48	BA130	3-3	2-8
AAZ13	BA130	3-3	2-8
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BA154	FDH900	3-56	2-4
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BA166	BA130	3-3	2-8
BA167	BA130	3-3	2-8
BA192	FDH400	3-53	2-6
BA193	FDH400	3-53	2-6
BA194	FDH400	3-53	2-6
BA197	FDH400	3-53	2-6
BA198	FDH400	3-53	2-6
BA200	BA218	3-4	2-8
BA217	BA217	3-4	2-8
BA218	BA218	3-4	2-8
BA316	FDH900	3-56	2-4
BA317	FDH900	3-56	2-4
BA318	FDH900	3-56	2-4
BAS13	FDH400	3-53	2-6
BAS36	FA2320E	3-49	—
BAV17	BAV17	3-6	2-8
BAV18	BAV18	3-6	2-8
BAV19	BAV19	3-6	2-7
BAV20	BAV20	3-6	2-6
BAV21	BAV21	3-6	2-6
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BAW11	BAY72	3-15	2-7
BAW12	FDH444	3-53	2-6
BAW16	FDH300	3-52	2-5
BAW17	FDH300	3-52	2-5
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BAW46	BAY72	3-15	2-7
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BAW75	BAW75	3-11	—
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BAW77	BAY72	3-15	2-7
BAX12	BAY74	3-17	2-4
BAX13	BAX13	3-12	2-3
BAX15	FDH400	3-53	2-6
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BAX37	FA2320E	3-49	—
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BAX39	FA4310E	3-49	—
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BAX43	FA4320E	3-49	—
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BAX87	BAY71	3-14	2-3
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BAX90A	BAY71	3-14	2-3
BAX90B	BAY71	3-14	2-3
BAX91A	BAY71	3-14	2-3
BAX91B	BAY71	3-14	2-3
BAX91C	BAY71	3-14	2-3
BAX92	BAY71	3-14	2-3
BAX93	BAY71	3-14	2-3
BAX94	BAY71	3-14	2-3
BAY17	BAY72	3-15	2-7
BAY18	BAY72	3-15	2-7
BAY19	BAY72	3-15	2-7
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BSY95	2N2369	3-246	2-24
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D29E5	2N4402	3-303	2-42
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D29E7	2N4403	3-303	2-42
D29E9	PN3645	3-150	2-44
D29E10	PN3645	3-150	2-44
D29F1	MPS3638	3-142	—
D29F2	MPS3638A	3-142	—
D29F3	PN4250	3-158	2-42
D29F4	2N5086	3-309	2-44
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D29F6	PN3645	3-150	2-44
D29F7	PN4250A	3-158	2-44
D32H1	MPSA05	3-110	2-34
D32H4	MPSA06	3-110	2-34
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D32L1	MPSA13	3-114	2-38
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D32L4	MPSA13	3-114	2-38
D32L5	MPSA14	3-114	2-38
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D32P2	PN3693	3-154	2-30
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D33E30	MPSA06	3-110	2-34
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EN697	PN3641	3-147	2-34
EN706	MPS706	3-222	2-24
EN708	PN4275	3-163	2-24
EN744	PN4275	3-163	2-24
EN914	PN3646	3-152	2-24
EN915	2N3903	3-278	2-32
EN916	2N4123	3-291	2-34
EN918	PN918	3-134	2-22
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EN2905	PN2905	3-258	2-42
EN3009	PN3646	3-152	2-24
EN3011	PN4275	3-163	2-24
EN3013	PN3646	3-152	2-24
EN3014	PN3646	3-152	2-24
EN3502	PN3644	3-150	2-44
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EN5172	MPS5172	3-101	2-36
FA2310	FA2310	3-49	—
FA2311	FA2311	3-49	—
FA2312	FA2312	3-49	—
FA2313	FA2313	3-49	—
FA2320	FA2320	3-49	—
FA2321	FA2321	3-49	—
FA2322	FA2322	3-49	—
FA2323	FA2323	3-49	—
FA2324	FA2324	3-49	—
FA2325	FA2325	3-49	—
FA2330	FA2330	3-49	—
FA2331	FA2331	3-49	—
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FA2334	FA2334	3-49	—
FA2335	FA2335	3-49	—
FA2360	FA2360	3-49	—
FA2361	FA2361	3-49	—
FA3310	FA3310	3-49	—
FA3311	FA3311	3-49	—
FA3312	FA3312	3-49	—
FA3313	FA3313	3-49	—
FA3320	FA3320	3-49	—
FA3321	FA3321	3-49	—
FA3322	FA3322	3-49	—
FA3323	FA3323	3-49	—
FA3324	FA3324	3-49	—
FA3325	FA3325	3-49	—
FA3330	FA3330	3-49	—
FA3331	FA3331	3-49	—
FA3332	FA3332	3-49	—
FA3333	FA3333	3-49	—
FA3334	FA3334	3-49	—
FA3335	FA3335	3-49	—
FA3360	FA3360	3-49	—
FA3361	FA3361	3-49	—
FA4310	FA4310	3-49	—
FA4311	FA4311	3-49	—
FA4312	FA4312	3-49	—
FA4313	FA4313	3-49	—
FA4320	FA4320	3-49	—
FA4321	FA4321	3-49	—
FA4322	FA4322	3-49	—
FA4323	FA4323	3-49	—
FA4324	FA4324	3-49	—
FA4325	FA4325	3-49	—
FA4330	FA4330	3-49	—
FA4331	FA4331	3-49	—
FA4332	FA4332	3-49	—
FA4333	FA4333	3-49	—
FA4334	FA4334	3-49	—
FA4335	FA4335	3-49	—
FA4360	FA4360	3-49	—
FA4361	FA4361	3-49	—
FD300	FDH300	3-52	2-5
FD333	FDH333	3-52	2-5
FD400	FDH400	3-53	2-6
FD444	FDH444	3-53	2-6
FD600	FDH600	3-54	2-3
FD666	FDH666	3-54	2-4
FD700	FD700	3-55	2-4
FD777	FD777	3-55	2-4

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FD2389	FD2389	3-49	—
FD3389	FD3389	3-49	—
FD6389	FD6389	3-49	—
FDH300	FDH300	3-52	2-5
FDH333	FDH333	3-52	2-5
FDH400	FDH400	3-53	2-6
FDH444	FDH444	3-53	2-6
FDH600	FDH600	3-54	2-3
FDH666	FDH666	3-54	2-4
FDH900	FDH900	3-56	2-4
FDH999	FDH999	3-56	2-4
FDH1000	FDH1000	3-57	2-4
FDN400	FDH400	3-53	2-6
FDN444	FDH444	3-53	2-6
FDN600	FDH600	3-54	2-3
FDN666	FDH666	3-54	2-4
FDN700	FD700	3-55	2-3
FDN777	FD777	3-55	2-3
FJT1100	FJT1100	3-62	2-5
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FPQ2222	FPQ2222	3-63	2-21
FPQ2907	FPQ2907	3-64	2-21
FPQ3724	FPQ3724	3-65	2-21
FPQ3725	FPQ3725	3-65	2-21
FPQ3904	FPQ3904	3-67	2-21
FPQ3906	FPQ3906	3-69	2-21
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FPQ6502	FPQ6502	3-73	2-21
FPQ6700	FPQ6700	3-75	2-21
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FPT100A	FPT100A	3-77	2-48
FPT100B	FPT100B	3-77	2-48
FPT110	FPT110	3-77	2-48
FPT110A	FPT110A	3-77	2-48
FPT110B	FPT110B	3-77	2-48
FPT120A	FPT120A	3-79	2-48
FPT120B	FPT120B	3-79	2-48
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FPT130B	FPT130B	3-79	2-48
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FSA1411M	FSA1411M	3-82	2-13
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FSA2503P	FSA2503P	3-86	2-14
FSA2504M	FSA2504M	3-86	2-14
FSA2509M	FSA2509M	3-87	2-14
FSA2509P	FSA2509P	3-87	2-14
FSA2510M	FSA2510M	3-87	2-14
FSA2510P	FSA2510P	3-87	2-14
FSA2563M	FSA2563M	3-89	2-14
FSA2563P	FSA2563P	3-89	2-14
FSA2564M	FSA2564M	3-89	2-14
FSA2564P	FSA2564P	3-89	2-14
FSA2565M	FSA2565M	3-89	2-44
FSA2565P	FSA2565P	3-89	2-14
FSA2566M	FSA2566M	3-89	2-14
FSA2566P	FSA2566P	3-89	2-14
FSA2619M	FSA2619M	3-91	2-14
FSA2619P	FSA2619P	3-91	2-14
FSA2620M	FSA2620M	3-91	2-14
FSA2620P	FSA2620P	3-91	2-14
FSA2621M	FSA2621M	3-91	2-14
FSA2702	FSA2702M	3-93	2-14
FSA2703M	FSA2703M	3-93	2-14
FSA2704M	FSA2704M	3-93	2-14
FSA2705M	FSA2705M	3-93	2-14
FSA2719M	FSA2619M	3-91	2-14
FSA2719P	FSA2619P	3-91	2-14
FSA2720M	FSA2720M	3-91	2-14
FSA2720P	FSA2720P	3-91	2-14
FSA2721M	FSA2721M	3-91	2-14
FSA2721P	FSA2721P	3-91	2-14
FT3903	2N3903	3-278	2-32
FT3904	2N3904	3-278	2-32
FT3905	2N3905	3-280	2-42
FT3906	2N3906	3-280	2-42
GE-10	MPS2924	3-94	2-36
GE-17	MPSA05	3-110	—
GE-20	2N4401	3-301	2-32
GET706	2N5772	3-152	2-24
GET708	2N5772	3-152	2-24
GET914	2N5772	3-152	2-24
GET929	MPS6514	3-102	2-36
GET930	MPS6514	3-102	2-36
GET2221	PN2221	3-236	2-34
GET2221A	PN2221A	3-238	2-32
GET2222	PN2222	3-240	2-34
GET2222A	PN2222A	3-242	2-32
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GET2904	PN2904	3-258	2-42
GET2905	PN2905	3-258	2-42
GET2906	PN2906	3-258	2-42
GET2907	PN2907	3-258	2-42
GET3013	2N5772	3-152	2-24
GET3014	2N5772	3-152	2-24
GET3563	PN3563	3-134	2-22
GET3638	MPS3638	3-142	—
GET3638A	MPS3638A	3-142	—
GET3646	MPS3646	3-152	2-24
GET5305	MPSA13	3-114	2-38
GET5306	MPSA14	3-114	2-38
GET5306A	MPSA14	3-114	2-38
GET5307	MPSA13	3-114	2-38
GET5308	MPSA14	3-114	2-38
GET5308A	MPSA14	3-114	2-38
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MC1103P	FSA2501	3-84	2-13
MC1105F	FSA2002M	3-82	2-13
MC1105L	FSA2563M	3-89	2-14
MC1105P	FSA2563	3-89	2-14
MC1106F	FSA2003M	3-82	2-13
MC1106L	FSA2564M	3-89	2-14
MC1106P	FSA2564	3-89	2-14
MC1107F	FSA2504M	3-86	2-14
MC1107L	FSA2503M	3-86	2-14
MC1107P	FSA2503	3-86	2-14
MD1103F	FSA2500M	3-84	2-13
MM1505	2N2369A	3-246	2-24
MM1748	2N2369A	3-246	2-24
MM1748A	2N2369A	3-246	2-24
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MM2055-2	2N2907	3-258	2-42
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MM3005	2N3019	3-264	2-28
MM3006	2N3019	3-264	2-28
MM3019	2N3019	3-264	2-28
MM3020	2N3020	3-264	2-28
MM3053	2N3053	3-266	2-28
MM3734	2N3724	3-276	2-22
MM3735	2N3725	3-276	2-22
MM3736	2N3724	3-276	2-22
MM3737	2N3725	3-276	2-22
MM4005	2N4030	3-286	2-46
MM4006	2N4033	3-286	2-46
MM4008	2N4032	3-286	2-46
MM4009	2N4033	3-286	2-46
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TID126	FSA2510M	3-87	2-14
TID131	FSA2504M	3-86	2-14
TID132	FSA2504M	3-86	2-14
TID133	FSA2509M	3-87	2-14
TID134	FSA2509M	3-87	2-14
TID135N	FSA2510M	3-87	2-14
TID136N	FSA2510M	3-87	2-14
TID139F	FSA2721M	3-91	2-14
TID139N	FSA2720M	3-91	2-14
TID140F	FSA2721M	3-91	2-14
TID140N	FSA2720M	3-91	2-14
TIS37	2N3905	3-280	2-42
TIS38	2N3905	3-280	2-42
TIS44	2N5772	3-152	2-24
TIS45	2N5772	3-152	2-24
TIS46	2N5772	3-152	2-24
TIS47	2N5769	3-246	2-24
TIS48	2N5769	3-246	2-24
TIS49	2N5769	3-246	2-24
TIS50	2N5771	3-338	2-26
TIS51	2N5769	3-246	2-24
TIS52	2N5772	3-152	2-24
TIS53	PN3640	3-144	2-26
TIS54	PN3640	3-144	2-26
TIS55	2N5772	3-152	2-26
TIS62	MPS918	3-134	2-22
TIS63	MPS918	3-134	2-22
TIS64	MPS918	3-134	2-22
TIS90	2N4401	3-301	2-32
TIS90M	2N4401	3-301	2-32
TIS91	2N4403	3-303	2-42
TIS91M	2N4403	3-303	2-42
TIS92	2N4401	3-301	2-32
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If you need the electrical characteristics for any of the listed industry standards, they are available and guaranteed by four device families. Each of these families are available in five configurations including; single, series, common cathode and common anode. Please see the appropriate data sheet for details.

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FTSO4126	FTSO4126	3-293	2-38
FTSO4208	FTSO4208	3-295	—
FTSO4209	FTSO4209	3-295	—
FTSO4248	FTSO4248	3-158	2-42
FTSO4249	FTSO4249	3-158	2-44
FTSO4250	FTSO4250	3-158	2-42
FTSO4258	FTSO4258	3-161	2-26
FTSO4274	FTSO4274	3-163	2-38
FTSO4275	FTSO4275	3-163	2-21
FTSO4354	FTSO4354	3-165	2-44
FTSO4355	FTSO4355	3-165	2-44
FTSO4356	FTSO4356	3-165	2-46
FTSO4400	FTSO4400	3-301	2-32
FTSO4401	FTSO4401	3-301	2-32
FTSO4402	FTSO4402	3-303	2-42
FTSO4403	FTSO4403	3-303	2-42
FTSO4409	FTSO4409	3-305	2-28
FTSO4410	FTSO4410	3-305	2-28

Industry Device	Fairchild Device	Data Sheet Page No.	Short Form Page No.
MMBTA55	FTSOA55	3-121	—
MMBTA56	FTSOA56	3-121	—
MMBTA70	FTSOA70	3-118	2-42
MPS706A	FTSO706A	3-222	2-22
MPS918	FTSO918	3-134	2-22
MPS2924	FTSO2924	3-94	2-34
MPS3392	FTSO3392	3-95	2-34
MPS3393	FTSO3393	3-95	2-34
MPS3639	FTSO3639	3-144	2-26
MPS3640	FTSO3640	3-144	2-26
MPS3646	FTSO3646	3-152	2-22
MPS3702	FTSO3702	3-98	2-38
MPS3703	FTSO3703	3-97	2-40
MPS3704	FTSO3704	3-99	2-40
MPS3705	FTSO3705	3-99	2-40
MPS5172	FTSO5172	3-101	2-34
MPS5551	FTSO5551	3-333	2-28
MPS6514	FTSO6514	3-102	2-36
MPS6515	FTSO6515	3-102	2-36
MPS6518	FTSO6518	3-103	2-42
MPS6520	FTSO6520	3-104	2-36
MPS6521	FTSO6521	3-104	2-36
MPS6560	FTSO6560	3-107	2-36
MPS6561	FTSO6561	3-107	2-36
MPS6562	FTSO6562	3-107	2-40
MPS6571	FTSO6571	3-109	2-36
MPSA05	FTSOA05	3-110	—
MPSA06	FTSOA06	3-110	—
MPSA13	FTSOA13	3-114	2-38
MPSA14	FTSOA14	3-114	2-38
MPSA20	FTSOA20	3-118	2-30
MPSA42	FTSOA42	3-119	2-26
MPSA43	FTSOA43	3-119	2-26
MPSA55	FTSOA55	3-121	2-44
MPSA56	FTSOA56	3-121	2-36
MPSA70	FTSOA70	3-118	2-42
MPSL01	FTSOL01	3-125	2-28
MPSL51	FTSOL51	3-125	2-46
PN930	FTSO930	3-226	2-30
PN2218	FTSO2218	3-237	2-32
PN2218A	FTSO2218A	3-239	2-30
PN2219	FTSO2219	3-241	2-32
PN2219A	FTSO2219A	3-243	2-30
PN2221	FTSO2221	3-237	2-34
PN2221A	FTSO2221A	3-239	2-30
PN2222	FTSO2222	3-241	2-34
PN2222A	FTSO2222A	3-243	2-32
PN2484	FTSO2484	3-251	2-28
PN2904	FTSO2904	3-258	2-40
PN2904A	FTSO2904A	3-260	2-44

Industry Device	Fairchild Device	Data Sheet Page No.	Short Form Page No.
PN2905	FTSO2905	3-258	2-40
PN2905A	FTSO2905A	3-260	2-44
PN2906	FTSO2906	3-258	2-40
PN2906A	FTSO2906A	3-260	2-44
PN2907	FTSO2907	3-258	2-40
PN2907A	FTSO2907A	3-260	2-44
PN3251	FTSO3251	3-269	2-40
PN3563	FTSO3563	3-134	2-22
PN3565	FTSO3565	3-137	2-34
PN3566	FTSO3566	3-138	2-34
PN3569	FTSO3569	3-140	2-32
PN3638	FTSO3638	3-142	2-38
PN3638A	FTSO3638A	3-142	2-38
PN3641	FTSO3641	3-147	2-34
PN3642	FTSO3642	3-147	2-30
PN3643	FTSO3643	3-147	2-34
PN3644	FTSO3644	3-150	2-44
PN3645	FTSO3645	3-150	2-44
PN3693	FTSO3693	3-154	2-30
PN3694	FTSO3694	3-154	2-30
PN4121	FTSO4121	3-156	2-42
PN4122	FTSO4122	3-156	2-42
PN4248	FTSO4248	3-158	2-42
PN4249	FTSO4249	3-158	2-44
PN4250	FTSO4250	3-158	2-42
PN4250A	FTSO4250A	3-158	—
PN4258	FTSO4258	3-161	2-26
PN4274	FTSO4274	3-163	2-38
PN4275	FTSO4275	3-163	2-22
PN4354	FTSO4354	3-165	2-44
PN4355	FTSO4355	3-165	2-44
PN4356	FTSO4356	3-165	2-46
PN4888	FTSO4888	3-168	2-46
PN4889	FTSO4889	3-168	2-46
PN4916	FTSO4916	3-171	2-40
PN4917	FTSO4917	3-171	2-40
PN5128	FTSO5128	3-172	2-38
PN5130	FTSO5130	3-174	2-22
PN5133	FTSO5133	3-176	2-38
PN5134	FTSO5134	3-177	2-38
PN5135	FTSO5135	3-179	2-34
PN5136	FTSO5136	3-179	2-36
PN5137	FTSO5137	3-179	2-36
PN5138	FTSO5138	3-182	2-40
PN5139	FTSO5139	3-184	2-38
PN5142	FTSO5142	3-186	2-38
PN5855	FTSO5855	3-190	2-44
PN5857	FTSO5857	3-190	2-46
PN5965	FTSO5965	3-192	2-26

FAIRCHILD
A Schlumberger Company

Diode Shortform Data

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Computer Diodes (By Ascending t_{rr})
Glass - Package

DEVICE NO.	t_{rr} ns Max	BV V Min	I_R nA Max	@	V_R V	V_F V Max	@	I_F mA	C pF Max	Package No.	Page No.
FD700	0.70	30	50		20	1.1		50	1.0	DO-7	3-55
1N4376	0.75	20	100		10	1.1		50	1.0	DO-7	3-18
1N4244	0.75	20	100		10	1.0		20	0.8	DO-7	3-18
BAY82	0.75	15	100		12	1.0		20	1.3	DO-7	3-18
FD777	0.75	15	100		8.0	1.0		20	1.3	DO-7	3-55
1N5282	2.0	80	100		55	1.3		500	2.5	DO-35	3-215
1N4153	2.0	75	50		50	0.88		20	4.0	DO-35	3-209
1N4151	2.0	75	50		50	1.0		50	4.0	DO-35	3-209
1N4305	2.0	75	100		50	0.85		10	2.0	DO-35	3-204
BAY71	2.0	50	100		35	1.0		20	2.0	DO-35	3-14
1N4152	2.0	40	50		30	0.88		20	4.0	DO-35	3-209
1N4154	2.0	35	100		25	1.0		30	4.0	DO-35	3-209
1N914	4.0	100	25		20	1.0		10	4.0	DO-35	3-201
1N914A	4.0	100	25		20	1.0		20	4.0	DO-35	3-201
1N914B	4.0	100	25		20	1.0		100	4.0	DO-35	3-201
1N916	4.0	100	25		20	1.0		10	2.0	DO-35	3-201
1N916A	4.0	100	25		20	1.0		20	2.0	DO-35	3-201
1N916B	4.0	100	25		20	1.0		30	2.0	DO-35	3-201
1N4148	4.0	100	25		20	1.0		10	4.0	DO-35	3-201
1N4149	4.0	100	25		20	1.0		10	2.0	DO-35	3-201
1N4446	4.0	100	25		20	1.0		20	4.0	DO-35	3-201
1N4447	4.0	100	25		20	1.0		20	4.0	DO-35	3-201
1N4448	4.0	100	25		20	1.0		100	2.0	DO-35	3-201
1N4449	4.0	100	25		20	1.0		30	2.0	DO-35	3-201
1N3600	4.0	75	100		50	1.0		200	2.5	DO-35	3-207
FDH600	4.0	75	100		50	1.0		200	2.5	DO-35	3-54
1N3064	4.0	75	100		50	1.0		10	2.0	DO-35	3-204
1N4150	4.0	75	100		50	1.0		200	2.5	DO-35	3-207
1N4454	4.0	75	100		50	1.0		10	2.0	DO-35	3-204
BAX13	4.0	50	200		50	1.0		20	3.0	DO-35	3-12

Computer Diodes (By Ascending t_{rr}) continued
Glass Package

DEVICE NO.	t_{rr} ns Max	BV V Min	I_R nA Max	@	V_R V	V_F V Max	@	I_F mA	C pF Max	Package No.	Page No.
BAY74	4.0	50	100		35	1.1		300	3.0	DO-35	3-17
FDH900	4.0	45	500		40	1.1		100	3.0	DO-35	3-56
FDH666	4.0	40	100		25	1.0		100	3.5	DO-35	3-54
1N4450	4.0	40	50		30	1.0		200	4.0	DO-35	3-207
1N4009	4.0	35	100		25	1.0		30	4.0	DO-35	3-208
1N625	4.0	30	1000		20	1.5		4.0	—	DO-35	3-197
FDH999	5.0	35	1000		25	1.0		10	5.0	DO-35	3-56
FDH1000	100	75	50		20	1.0		500	5.0	DO-35	3-57

Computer Diodes (By Ascending t_{rr}) continued
Leadless Glass Package

Device No.	t_{rr} ns Max.	B_V V Min.	I_R nA Max.	@	V_R V	V_F V Max.	@	I_F mA	C pF Max.	Pkg. No.	Page No.
FDLL4153	2.0	75	50		50	0.88		20	4.0	LL-34	3-209
FDLL4151	2.0	75	50		50	1.0		50	4.0	LL-34	3-209
FDLL4305	2.0	75	100		50	0.85		10	2.0	LL-34	3-204
FDLL4152	2.0	40	50		30	0.88		20	4.0	LL-34	3-209
FDLL4154	2.0	35	100		25	1.0		30	4.0	LL-34	3-209
FDLL914	4.0	100	25		20	1.0		10	4.0	LL-34	3-201
FDLL914A	4.0	100	25		20	1.0		20	4.0	LL-34	3-201
FDLL914B	4.0	100	25		20	1.0		100	4.0	LL-34	3-201
FDLL916	4.0	100	25		20	1.0		10	2.0	LL-34	3-201
FDLL916A	4.0	100	25		20	1.0		20	2.0	LL-34	3-201
FDLL916B	4.0	100	25		20	1.0		30	2.0	LL-34	3-201
FDLL4148	4.0	100	25		20	1.0		10	4.0	LL-34	3-201
FDLL4149	4.0	100	25		20	1.0		10	2.0	LL-34	3-201
FDLL4446	4.0	100	25		20	1.0		20	4.0	LL-34	3-201
FDLL4447	4.0	100	25		20	1.0		20	4.0	LL-34	3-201
FDLL4448	4.0	100	25		20	1.0		100	2.0	LL-34	3-201
FDLL4449	4.0	100	25		20	1.0		30	2.0	LL-34	3-201
FDLL3600	4.0	75	100		50	1.0		200	2.5	LL-34	3-207
FDLL600	4.0	75	100		50	1.0		200	2.5	LL-34	3-54
FDLL3064	4.0	75	100		50	1.0		10	2.0	LL-34	3-204

Computer Diodes (By Ascending t_{rr}) continued
Leadless Glass Package

Device No.	t_{rr} ns Max.	B_V V Min.	I_R nA Max. @	V_R V	V_F V Max. @	I_F mA	C pF Max.	Pkg. No.	Page No.
FDLL4150	4.0	75	100	50	1.0	200	2.5	LL-34	3-207
FDLL4454	4.0	75	100	50	1.0	10	2.0	LL-34	3-204
FDLL666	4.0	40	100	25	1.0	100	3.5	LL-34	3-54
FDLL4450	4.0	40	50	30	1.0	200	4.0	LL-34	3-207
FDLL4009	4.0	35	100	25	1.0	30	4.0	LL-34	3-208
FDLL625	50	30	1000	20	1.5	4.0		LL-34	3-197

Low Leakage Diodes (By Descending B_V)
Glass Package

DEVICE NO.	BV V Min	I_R nA Max @	V_R V	V_F V Max @	I_F mA	C pF Max	Package No.	Page No.
1N485B	200	25	180	1.0	100	—	DO-35	3-196
1N459	200	25	175	1.0	3.0	—	DO-35	3-194
1N459A	200	25	175	1.0	100	—	DO-35	3-194
FDH300	150	1.0	125	1.0	200	6.0	DO-35	3-52
1N3595	150	1.0	125	1.0	200	8.0	DO-35	3-206
1N6099	150	1.0	125	1.0	200	8.0	DO-35	3-206
FDH333	150	3.0	125	1.05	200	6.0	DO-35	3-52
1N458A	150	5.0	125	1.0	100	—	DO-35	3-194
1N484B	150	25	130	1.0	100	—	DO-35	3-196
1N458	150	25	125	1.0	7.0	6.0	DO-35	3-194
BAY73	125	5.0	100	1.0	200	8.0	DO-35	3-16
1N483B	80	25	70	1.0	100	—	DO-35	3-196
1N457	70	25	60	1.0	20	8.0	DO-35	3-194
1N457A	70	25	60	1.0	100	—	DO-35	3-194
1N482B	40	25	36	1.0	100	—	DO-35	3-196
FJT1100	30	0.001	5.0	1.05	10	1.5	DO-7	3-62
1N456A	30	25	25	1.0	100	—	DO-35	3-194
1N456	30	25	25	1.0	40	10	DO-35	3-194

Low Leakage Diodes (by Descending B_V)
Leadless Glass Package

Device No.	B_V V Min.	I_R nA Max.	@	V_R V	V_F V Max.	@	I_F mA	C pF Max.	Pkg. No.	Page No.
FDLL485B	200	25		180	1.0		100		LL-34	3-196
FDLL459	200	25		175	1.0		3.0		LL-34	3-194
FDLL459A	200	25		175	1.0		100		LL-34	3-194
FDLL300	150	1.0		125	1.0		200	6.0	LL-34	3-52
FDLL3595	150	1.0		125	1.0		200	8.0	LL-34	3-206
FDLL6099	150	1.0		125	1.0		200	8.0	LL-34	3-206
FDLL333	150	3.0		125	1.05		200	6.0	LL-34	3-52
FDLL458A	150	5.0		125	1.0		100		LL-34	3-194
FDLL484B	150	25		130	1.0		100		LL-34	3-196
FDLL458	150	25		125	1.0		7.0	6.0	LL-34	3-194
FDLL483B	80	25		70	1.0		100		LL-34	3-196
FDLL457	70	25		60	1.0		20	8.0	LL-34	3-194
FDLL457A	70	25		60	1.0		100		LL-34	3-194
FDLL482B	40	25		36	1.0		100		LL-34	3-196
FDLL456A	30	25		25	1.0		100		LL-34	3-194
FDLL456	30	25		25	1.0		40	10	LL-34	3-194

High Voltage Diodes (By Descending B_V)
Glass Package

DEVICE NO.	BV V Min	I_R nA Max	@	V_R V	V_F V Max	@	I_F mA	C pF Max	t_{rr} ns Max	Package No.	Page No.
BAV21	250	100		200	1.0		100	—	50	DO-35	3-6
1N661	240	10000		200	1.0		6.0	—	300	DO-35	3-199
FDH400	200	100		150	1.0		200	2.0	50	DO-35	3-53
1N3070	200	100		175	1.0		100	5.0	50	DO-35	3-205
1N4938	200	100		175	1.0		100	5.0	50	DO-35	3-205
BAV20	200	100		150	1.0		100	—	50	DO-35	3-6
1N629	200	1000		175	1.5		4.0	—	1000	DO-35	3-197
FDH444	150	50		100	1.1		200	2.5	60	DO-35	3-53
1N628	150	1000		125	1.5		4.0	—	1000	DO-35	3-197

High Voltage Diodes (By Descending B_V)
Glass Package

DEVICE NO.	BV V Min	I_R nA Max	@	V_R V	V_F V Max	@	I_F mA	C pF Max	t_{rr} ns Max	Package No.	Page No.
BAY72	125	100		100	1.0		100	5.0	50	DO-35	3-15
BAY80	120	100		120	1.0		150	6.0	—	DO-35	3-15
BAV19	120	100		100	1.0		100	—	50	DO-35	3-6
1N658	120	50		50	1.0		100	—	300	DO-35	3-198
1N660	120	5000		100	1.0		6.0	—	300	DO-35	3-199
1N627	100	1000		75	1.5		4.0	—	1000	DO-35	3-197
1N626	50	1000		35	1.5		4.0	—	1000	DO-35	3-197

High Voltage Diodes (By Descending B_V)
Leadless Glass Package

Device No.	B_V V Min.	I_R nA Max.	@	V_R V	V_F V Max.	@	I_F mA	C pF Max.	t_{rr} ns Max.	Pkg. No.	Page No.
FDLL400	200	100		150	1.0		200	2.0	50	LL-34	3-53
FDLL3070	200	100		175	1.0		100	5.0	50	LL-34	3-205
FDLL629	200	1000		175	1.5		4.0		1000	LL-34	3-197
FDLL444	150	50		100	1.1		200	2.5	60	LL-34	3-53
FDLL628	150	1000		125	1.5		4.0		1000	LL-34	3-197
FDLL658	120	50		50	1.0		100		300	LL-34	3-198
FDLL660	120	5000		100	1.0		6.0		300	LL-34	3-199
FDLL627	100	1000		75	1.5		4.0		1000	LL-34	3-197
FDLL626	50	1000		35	1.5		4.0		1000	LL-34	3-197

Diode Shortform Data

General Purpose Diodes (By Descending B_V)
Glass Package

DEVICE NO.	BV V Min	I_R nA Max	@	V_R V	V_F V Max	@	I_F mA	C pF Max	t_{rr} ns Max	Package No.	Page No.
BA128	75	100		50	1.0		50	5.0	—	DO-35	3-3
1N462A	70	500		60	1.0		100	—	—	DO-35	3-195
BAV18	60	100		50	1.0		100	—	50	DO-35	3-6
1N659	60	5000		50	1.0		6.0	—	—	DO-35	3-199
1S920	50	100		50	1.2		200	—	—	DO-35	3-220
BA218	50	50		25	1.0		10	5.0	—	DO-35	3-4
1S44	50	50		10	1.15		10	6.0	—	DO-35	3-219
FDH900	45	500		40	1.1		100	3.0	4.0	DO-35	3-56
FDH999	35	1000		25	1.0		10	5.0	5.0	DO-35	3-56
1N461A	30	500		25	1.0		100	10	—	DO-35	3-195
BA217	30	50		10	1.0		10	5.0	—	DO-35	3-4
BA130	30	100		25	1.0		10	2.0	—	DO-35	3-3
BAV17	25	100		20	1.0		100	—	50	DO-35	3-6
1N661	240	10000		200	1.0		6.0	—	300	DO-35	3-199
1S923	200	100		200	1.2		200	—	—	DO-35	3-220
1N463A	200	500		175	1.0		100	—	—	DO-35	3-195
1S922	150	100		150	1.2		200	—	—	DO-35	3-220
BAX16	150	100		150	1.0		1.0	10	120	DO-35	3-13
1N660	120	5000		100	1.0		6.0	—	—	DO-35	3-199
1S921	100	100		100	1.2		200	—	—	DO-35	3-220

General Purpose Diodes (By Descending B_V)
Leadless Glass Package

Device No.	B_V V Min.	I_R nA Max.	@	V_R V	V_F V Max.	@	I_F mA	C pF Max.	Pkg. No.	Page No.
FDLL661	240	10000		200	1.0		6.0		LL-34	3-199
FDLL923	200	100		200	1.2		200		LL-34	3-220
FDLL463A	200	500		175	1.0		100		LL-34	3-195
FDLL922	150	100		150	1.2		200		LL-34	3-220
FDLL921	100	100		100	1.2		200		LL-34	3-220

General Purpose Diodes (By Descending B_V)
Leadless Glass Package

Device No.	B_V V Min.	I_R nA Max.	@ V_R V	V_F V Max.	@ I_F mA	C pF Max.	Pkg. No.	Page No.
FDLL462A	70	500	60	1.0	100		LL-34	3-195
FDLL659	60	5000	50	1.0	6.0		LL-34	3-199
FDLL920	50	100	50	1.2	200		LL-34	3-220
FDLL44	50	50	10	.15	10	6.0	LL-34	3-219
FDLL461A	30	500	25	1.0	100	10	LL-34	3-195

Surface Mount Diodes
Plastic Package

Device	Description	t_{rr} ns Max.	B_V V Min.	I_R nA Max.	@ V_R V	V_F V Max.	@ I_F mA	C pF Max.	Pkg. No.	Page No.
FDSO 1200 FAMILY										
FDSO1201	Single	4.0	100	25	20	1.0	200	2.0	TO-236	3-58
FDSO1202	Single	4.0	100	25	20	1.0	200	2.0	TO-236	3-58
FDSO1203	Series	4.0	100	25	20	1.0	200	2.0	TO-236	3-58
FDSO1204	Common Cathode	4.0	100	25	20	1.0	200	2.0	TO-236	3-58
FDSO1205	Common Anode	4.0	100	25	20	1.0	200	2.0	TO-236	3-58
FDSO 1400 FAMILY										
FDSO1401	Single	50	200	100	175	1.0	200	2.0	TO-236	3-59
FDSO1402	Single	50	200	100	175	1.0	200	2.0	TO-236	3-59
FDSO1403	Series	50	200	100	175	1.0	200	2.0	TO-236	3-59
FDSO1404	Common Cathode	50	200	100	175	1.0	200	2.0	TO-236	3-59
FDSO1405	Common Anode	50	200	100	175	1.0	200	2.0	TO-236	3-59
FDSO 1500 FAMILY										
FDSO1501	Single	—	200	1.0	125	1.0	200	4.0	TO-236	3-60
FDSO1502	Single	—	200	1.0	125	1.0	200	4.0	TO-236	3-60
FDSO1503	Series	—	200	1.0	125	1.0	200	4.0	TO-236	3-60
FDSO1504	Common Cathode	—	200	1.0	125	1.0	200	4.0	TO-236	3-60
FDSO1505	Common Anode	—	200	1.0	125	1.0	200	4.0	TO-236	3-60

Diode Shortform Data

Surface Mount Diodes
Plastic Package

Device	Description	t_{rr} ns Max.	B_V V Min.	I_R nA Max.	@ V_R V	V_F V Max.	@ I_F mA	C pF Max.	Pkg. No.	Page No.
FSDO 1700 FAMILY										
FDSO1701	Single	0.7	30	50	20	1.1	50	1.0	TO-236	3-61
FDSO1702	Single	0.7	30	50	20	1.1	50	1.0	TO-236	3-61
FDSO1703	Series	0.7	30	50	20	1.1	50	1.0	TO-236	3-61
FDSO1704	Common Cathode	0.7	30	50	20	1.1	50	1.0	TO-236	3-61
FDSO1705	Common Anode	0.7	30	50	20	1.1	50	1.0	TO-236	3-61
BAS16	Single	6.0	75	1000	75	1.1	50	2.0	TO-236	3-5
BAV70	Common Cathode	6.0	70	5000	70	1.1	50	1.5	TO-236	3-7
BAV74	Common Cathode	4.0	50	100	50	1.0	100	2.0	TO-236	3-8
BAV99	Series	6.0	70	2500	70	1.1	50	1.5	TO-236	3-9
BAW56	Common Anode	6.0	70	2500	70	1.1	50	2.5	TO-236	3-10

Military Qualified Diodes (Numeric Order)
Metal Packages

DEVICE NO.	BV V Min	I_R nA Max	@ V_R V	V_F V Max	@ I_F mA	C pF Max	t_{rr} ns Max	Package No.
1N457JAN	70	25	60	1.0	20	6.0	—	DO-35
1N458JAN	150	25	125	1.0	7.0	6.0	—	DO-35
1N459JAN	200	25	175	1.0	3.0	6.0	—	DO-35
1N483BJAN	80	25	70	1.0	100	—	—	DO-35
1N483BJANTX	80	25	70	1.0	100	—	—	DO-35
1N485BJAN	200	25	180	1.0	100	—	—	DO-35
1N485BJANTX	200	25	180	1.0	100	—	—	DO-35
1N486BJAN	250	25	225	1.0	100	—	—	DO-35
1N486BJANTX	250	25	225	1.0	100	—	—	DO-35

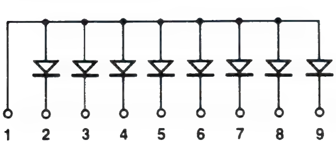
Military Qualified Diodes (Numeric Order) continued
Metal Packages

DEVICE NO.	BV V Min	I_R nA Max @	V_R V	V_F V Max @	I_F mA	C pF Max	t_{rr} ns Max	Package No.
1N914JAN	100	25	20	1.0	10	4.0	4.0	DO-35
1N914JANTX	100	25	20	1.0	10	4.0	4.0	DO-35
1N3064JAN	75	100	50	1.0	10	2.0	4.0	DO-7
1N3064JANTX	75	100	50	1.0	10	2.0	4.0	DO-7
1N3595JAN	150	1.0	125	1.0	200	8.0	3000	DO-7
1N3595JANTX	150	1.0	125	1.0	200	8.0	3000	DO-7
1N3595JANTXV	150	1.0	125	1.0	200	8.0	3000	DO-7
1N3600JAN	75	100	50	1.0	200	2.5	4.0	DO-7
1N3600JANTX	75	100	50	1.0	200	2.5	4.0	DO-7
1N3600JANTXV	75	100	50	1.0	200	2.5	4.0	DO-7
1N4148JAN	100	25	20	1.0	10	4.0	4.0	DO-35
1N4148JANTX	100	25	20	1.0	10	4.0	4.0	DO-35
1N4148JANTXV	100	25	20	1.0	10	4.0	4.0	DO-35
1N4148-1JAN	100	25	20	1.0	10	4.0	4.0	DO-35
1N4148-1JANTX	100	25	20	1.0	10	4.0	4.0	DO-35
1N4148-1JANTXV	100	25	20	1.0	10	4.0	4.0	DO-35
1N4150JAN	75	100	50	1.0	200	2.5	4.0	DO-35
1N4150JANTX	75	100	50	1.0	200	2.5	4.0	DO-35
1N4150JANTXV	75	100	50	1.0	200	2.5	4.0	DO-35
1N4150-1JAN	75	100	50	1.0	200	2.5	4.0	DO-35
1N4150-1JANTX	75	100	50	1.0	200	2.5	4.0	DO-35
1N4150-1JANTXV	75	100	50	1.0	200	2.5	4.0	DO-35
1N4376JAN	20	100	10	1.1	50	1.0	0.75	DO-7
1N4376JANTX	20	100	10	1.1	50	1.0	0.75	DO-7
1N4454JAN	75	100	50	1.0	10	2.0	4.0	DO-35
1N4454JANTX	75	100	50	1.0	10	2.0	4.0	DO-35
1N4454JANTXV	75	100	50	1.0	10	2.0	4.0	DO-35
1N4454-1JAN	75	100	50	1.0	10	2.0	4.0	DO-35
1N4454-JANTX	75	100	50	1.0	10	2.0	4.0	DO-35
1N4454-1JANTXV	75	100	50	1.0	10	2.0	4.0	DO-35

Military Qualified Diode Arrays (Numeric Listing)
Ceramic Package

DEVICE NO.	BV V Min	V_F V Max	@	I_F mA	t_{fr} ns Max	t_{rr} ns Max	Configuration	Package No.
1N5768JAN	60	1.0		100	40	20	CC8	TO-85
1N5768JANTX	60	1.0		100	40	20	CC8	TO-85
1N5768JANTXV	60	1.0		100	40	20	CC8	TO-85
1N5770JAN	60	1.0		100	40	20	CA8	TO-85
1N5770JANTX	60	1.0		100	40	20	CA8	TO-85
1N5770JANTXV	60	1.0		100	40	20	CA8	TO-85
1N5772JAN	60	1.0		100	40	20	M16	TO-85
1N5772JANTX	60	1.0		100	40	20	M16	TO-85
1N5772JANTXV	60	1.0		100	40	20	M16	TO-85
1N5774JAN	60	1.0		100	40	20	2M8	TO-86
1N5774JANTX	60	1.0		100	40	20	2M8	TO-86
1N5774JANTXV	60	1.0		100	40	20	2M8	TO-86
1N6100JAN	75	1.0		100	15	5.0	S7	TO-86
1N6100JANTX	75	1.0		100	15	5.0	S7	TO-86
1N6100JANTXV	75	1.0		100	15	5.0	S7	TO-86
1N6101JAN	75	1.0		100	15	5.0	S7	TO-116-2
1N6101JANTX	75	1.0		100	15	5.0	S7	TO-116-2
1N6101JANTXV	75	1.0		100	15	5.0	S7	TO-116-2

Configurations



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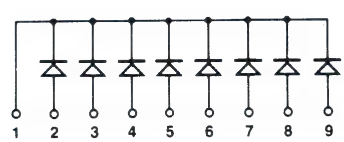

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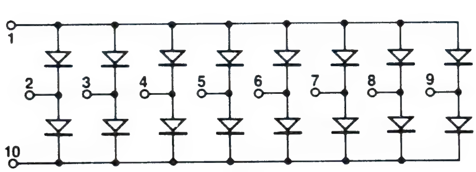
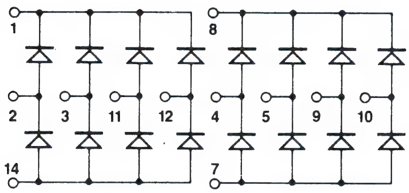


M16

Configurations



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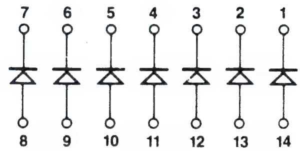


S7

Military Qualified Diode Assemblies
Unencapsulated Package

DEVICE NO.	BV V Min	I_R nA Max	@	V_R V	V_F V Max	@	I_F mA	C pF Max	t_{rr} ns Max	Package No.
1N4306JAN	75	50		50	1.0		50	2.0	4.0	DO-7
1N4306JANTX	75	50		50	1.0		50	2.0	4.0	DO-7
1N4306JANTXV	75	50		50	1.0		50	2.0	4.0	DO-7
1N4307JAN	75	50		50	1.0		50	2.0	4.0	DO-7
1N4307JANTX	75	50		50	1.0		50	2.0	4.0	DO-7
1N4307JANTXV	75	50		50	1.0		50	2.0	4.0	DO-7

Monolithic Diode Arrays (Numberic Listing) continued
Plastic – Ceramic – Metal Packages

DEVICE NO.	BV V Min	V_F V Max	@	I_F mA	ΔV_F mV Max	t_{rr} ns Max	Configuration	Package No.	Page No.
FSA1410M	60	1.0		100	15	10	CA8	TO-96	3-82
FSA1411M	60	1.0		100	15	10	CC8	TO-96	3-82
FSA2002M	60	1.0		100	15	10	CC8	TO-85	3-82
FSA2003M	60	1.0		100	15	10	CA8	TO-85	3-82
FSA2500M	60	1.0		100	15	10	M16	TO-85	3-84
FSA2501M	60	1.0		100	15	10	M16	TO-116-2	3-84
FSA2501P	60	1.0		100	15	10	M16	TO-116	3-84
FSA2502M	60	1.0		100	15	10	M16	TO-96	3-84

Monolithic Diode Arrays (Numeric Listing)
Plastic - Ceramic - Metal Packages

DEVICE NO.	BV V Min	V_F V Max	@	I_F mA	ΔV_F mV Max	t_{rr} ns Max	Configuration	Package No.	Page No.
FSA2503M	60	1.0		100	15	10	2M8	TO-116-2	3-86
FSA2503P	60	1.0		100	15	10	2M8	TO-116	3-86
FSA2504M	60	1.0		100	15	10	2M8	TO-86	3-86
FSA2509M	60	1.3		500	15	10	2M8	TO-116-2	3-87
FSA2509P	60	1.3		500	15	10	2M8	TO-116	3-87
FSA2510M	60	1.3		500	15	10	M16	TO-116-2	3-87
FSA2510P	60	1.3		500	15	10	M16	TO-116	3-87
FSA2563M	60	1.3		500	15	10	CC8	TO-116-2	3-89
FSA2563P	60	1.3		500	15	10	CC8	TO-116	3-89
FSA2564M	60	1.3		500	15	10	CA8	TO-116-2	3-89
FSA2564P	60	1.3		500	15	10	CA8	TO-116	3-89
FSA2565M	60	1.3		500	15	10	CC13	TO-116-2	3-89
FSA2565P	60	1.3		500	15	10	CC13	TO-116	3-89
FSA2566M	60	1.3		500	15	10	CA13	TO-116-2	3-89
FSA2566P	60	1.3		500	15	10	CA13	TO-116	3-89
FSA2619M	100	1.0		10	15	5	S8	6B	3-91
FSA2619P	100	1.0		10	15	5	S8	9B	3-91
FSA2620M	100	1.0		10	15	5	S7	TO-116-2	3-91
FSA2620P	100	1.0		10	15	5	S7	TO-116	3-91
FSA2621M	100	1.0		10	15	5	S7	TO-86	3-91
FSA2621M	100	1.0		10	15	5	S7	TO-116	3-91
FSA2702M	60	1.0		200	3	5	R4	TO-33	3-93
FSA2703M	60	1.0		200	3	6	R4	TO-72	3-93
FSA2704M	60	1.0		200	—	6	R4	TO-33	3-93
FSA2705M	60	1.0		200	—	6	R4	TO-72	3-93
FSA2719M	75	1.0		10	15	6	S8	6B	3-91
FSA2719P	75	1.0		10	15	6	S8	9B	3-91
FSA2720M	75	1.0		10	15	6	S7	TO-116-2	3-91
FSA2720P	75	1.0		10	15	6	S7	TO-116	3-91
FSA2721M	75	1.0		10	15	6	S7	TO-86	3-91

Monolithic Diode Arrays (Numeric Listing) cont.

Plastic – Ceramic – Metal Packages

DEVICE NO.	BV V Min	V_F V Max	@	I_F mA	ΔV_F mV Max	t_{rr} ns Max	Configuration	Package No.	Page No.
FSA2721M	75	1.0		10	15	6	S7	TO-86	3-91
1N5768	60	1.0		100	—	20	CC8	TO-85	3-216
1N5770	60	1.0		100	—	20	CA8	TO-85	3-216
1N5772	60	1.0		100	—	20	M16	TO-85	3-216
1N5774	60	1.0		100	—	20	2M8	TO-86	3-216
1N6100	75	1.0		100	—	5	S7	TO-86	3-218
1N6101	75	1.0		100	—	5	S7	TO-116-2	3-218

Surface Mount Monolithic Diode Arrays

Plastic Packages

Device No.	B_V V Min.	V_F V Max.	@	I_F mA	ΔV_F mV Max.	t_{rr} ns Max.	Config.	Pkg. No.	Page No.
FASO2501	60	1.0		100	15	10	M16	14-SOIC	3-84
FASO2503	60	1.0		100	15	10	2M8	14-SOIC	3-86
FASO2509	60	1.3		500	15	10	2M8	14-SOIC	3-87
FASO2510	60	1.3		500	15	10	M16	14-SOIC	3-87
FASO2563	60	1.3		500	15	10	CC8	14-SOIC	3-89
FASO2564	60	1.3		500	15	10	CA8	14-SOIC	3-89
FASO2565	60	1.3		500	15	10	CC13	16-SOIC	3-89
FASO2566	60	1.3		500	15	10	CA13	16-SOIC	3-89
FASO2618	75	10		10	50	5.0	S4	8-SOIC	3-50
FASO2718	100	1.0		10	50	6.0	S4	8-SOIC	3-50
FASO2619	100	1.0		10	15	5.0	S8	16-SOIC	3-91
FASO2620	100	1.0		10	15	5.0	S7	14-SOIC	3-91
FASO2719	75	1.0		10	15	6.0	S8	16-SOIC	3-91
FASO2720	75	1.0		10	15	6.0	S7	14-SOIC	3-91
FASO5768	60	1.0		100		20	CC8	8-SOIC	3-216
FASO5770	60	1.0		100		20	CA8	8-SOIC	3-216
FASO5772	60	1.0		100		20	M16	8-SOIC	3-216
FASO5774	60	1.0		100		20	2M8	14-SOIC	3-216
FASO6101	75	1.0		100		5.0	S7	14-SOIC	3-218

Zener Diodes (By Ascending V_Z)
Glass Package

Device No.	V_Z V Nom.	Tol.* $\pm V_Z$ %	Z_Z Ω Max.	@I_Z mA	I_R μA Max. @	V_R V	T.C. %/°C Typ (Max)	P_D mW T_A=25°C	Pkg. No.	Page No.
1N746A	3.3	5.0	28	20	10	1.0	-.070	500	DO-35	3-200
1N5226B	3.3	5.0	28	20	25	1.0	(-.070)	500	DO-35	3-213
1N4728A	3.3	5.0	10	76	100	1.0		1000	DO-41	3-211
1N747A	3.6	5.0	24	20	10	1.0	-0.65	500	DO-35	3-200
1N5227B	3.6	5.0	24	20	15	1.0	(-.065)	500	DO-35	3-213
1N4729A	3.6	5.0	10	69	100	1.0		1000	DO-41	3-211
1N748A	3.9	5.0	23	20	10	1.0	-0.60	500	DO-35	3-200
1N5228B	3.9	5.0	23	20	10	1.0	(-.060)	500	DO-35	3-213
1N4730A	3.9	5.0	9.0	64	50	1.0		1000	DO-41	3-211
1N749A	4.3	5.0	22	20	2.0	1.0	±.055	500	DO-35	3-200
1N5229B	4.3	5.0	22	20	5.0	1.0	(±.055)	500	DO-35	3-213
1N4731A	4.3	5.0	9.0	58	10	1.0		1000	DO-41	3-211
1N750A	4.7	5.0	19	20	2.0	1.0	±.043	500	DO-35	3-200
1N5230B	4.7	5.0	19	20	5.0	2.0	(±.030)	500	DO-35	3-213
1N4732A	4.7	5.0	8.0	53	10	1.0		1000	DO-41	3-211
1N751A	5.1	5.0	17	20	1.0	1.0	±.030	500	DO-35	3-200
1N5231B	5.1	5.0	17	20	5.0	2.0	(±.030)	500	DO-35	3-213
1N4733A	5.1	5.0	7.0	49	10	1.0		1000	DO-41	3-211
1N752A	5.6	5.0	11	20	1.0	1.0	+.028	500	DO-35	3-200
1N5232B	5.6	5.0	11	20	5.0	3.0	(±.038)	500	DO-35	3-213
1N4734A	5.6	5.0	5.0	45	10	2.0		1000	DO-41	3-211
1N5233B	6.0	5.0	7.0	20	5.0	3.5	(±.038)	500	DO-35	3-213
1N753A	6.2	5.0	7.0	20	0.1	1.0	+.045	500	DO-35	3-200
1N5234B	6.2	5.0	7.0	20	5.0	4.0	(+.045)	500	DO-35	3-213
1N4735A	6.2	5.0	2.0	41	10	3.0		1000	DO-41	3-211
1N754A	6.8	5.0	5.0	20	0.1	1.0	+.050	500	DO-35	3-200
1N957B	6.8	5.0	4.5	18.5	150	5.2	+.050	500	DO-35	3-203
1N5235B	6.8	5.0	5.0	20	3.0	5.0	(+.050)	500	DO-35	3-213
1N4736A	6.8	5.0	3.5	37	10	4.0		1000	DO-41	3-211
1N755A	7.5	5.0	6.0	20	0.1	1.0	+.058	500	DO-35	3-200
1N958B	7.5	5.0	5.5	16.5	75	5.7	+.058	500	DO-35	3-203

Tolerance: All zener diodes are also available in ±1%, ±2%, ±10% and ±20% tolerances.

Zener Diodes (By Ascending V_Z) continued
Glass Package

DEVICE NO.	V_Z V Nom	Tol. $\pm V_Z$ %	Z_Z Ω Max	@I_Z mA	I_R µA Max	@ V_R V	T.C. %/°C Typ (Max)	P_D mW T_A=25°C	Package No.	Page No.
1N5236B	7.5	5.0	6.0	20	3.0	6.0	(+.058)	500	DO-35	3-213
1N4737A	7.5	5.0	4.0	34	10	5.0		1000	DO-41	3-211
1N756A	8.2	5.0	8.0	20	0.1	1.0	+.062	500	DO-35	3-200
1N959B	8.2	5.0	6.5	15	50	6.2	+.062	500	DO-35	3-203
1N5237B	8.2	5.0	8.0	20	3.0	6.5	(+.062)	500	DO-35	3-213
1N4738A	8.2	5.0	4.5	34	10	6.0		1000	DO-41	3-211
1N5238B	8.7	5.0	8.0	20	3.0	6.5	(+.065)	500	DO-35	3-213
1N757A	9.1	5.0	10	20	0.1	1.0	+.068	500	DO-35	3-200
1N960B	9.1	5.0	7.5	14	25	6.9	+.068	500	DO-35	3-203
1N5239B	9.1	5.0	10	20	3.0	7.0	(+.068)	500	DO-35	3-213
1N4739A	9.1	5.0	5.0	8	10	7.0		1000	DO-41	3-211
1N758A	10	5.0	17	20	0.1	1.0	+.075	500	DO-35	3-200
1N961B	10	5.0	8.5	12.5	10	7.6	+.072	500	DO-35	3-203
1N5240B	10	5.0	17	20	3.0	8.0	(+.075)	500	DO-35	3-213
1N4740A	10	5.0	7.0	25	10	7.6		1000	DO-41	3-211
1N962B	11	5.0	9.5	11.5	5.0	8.4	+.073	500	DO-35	3-203
1N5241B	11	5.0	22	20	2.0	8.4	(+.076)	500	DO-35	3-213
1N4741A	11	5.0	8.0	23	5.0	8.4		1000	DO-41	3-211
1N759A	12	5.0	30	20	0.1	1.0	+.077	500	DO-35	3-200
1N963B	12	5.0	11.5	10.5	5.0	9.1	+.076	500	DO-35	3-203
1N5242B	12	5.0	30	20	1.0	9.1	(+.077)	500	DO-35	3-213
1N4742A	12	5.0	9.0	21	5.0	9.1		1000	DO-41	3-211
1N964B	13	5.0	13	9.5	5.0	9.9	+.079	500	DO-35	3-203
1N5243B	13	5.0	13	9.5	0.5	9.9	(+.079)	500	DO-35	3-213
1N4743A	13	5.0	10	19	5.0	9.9		1000	DO-41	3-211
1N5244B	14	5.0	15	9.0	0.1	10	(+.082)	500	DO-35	3-213
1N965B	15	5.0	16	8.5	5.0	11.4	+.082	500	DO-35	3-203
1N5245B	15	5.0	16	8.5	0.1	11	(+.082)	500	DO-35	3-213
1N4744A	15	5.0	14	17	5.0	11.4		1000	DO-41	3-211
1N966B	16	5.0	17	7.8	5.0	12.2	+.083	500	DO-35	3-203
1N5246B	16	5.0	17	7.8	0.1	12	(+.083)	500	DO-35	3-213
1N4745A	16	5.0	16	15.5	5.0	12.2		1000	DO-41	3-211
1N5247B	17	5.0	19	7.4	0.1	13	(+.084)	500	DO-35	3-213

Zener Diodes (By Ascending V_Z) cont.
Glass Package

DEVICE NO.	V_Z V Nom	Tol.* $\pm V_Z$ %	Z_Z Ω Max	@I_Z mA	I_R µA Max	@ V_R V	T.C. %/°C Typ (Max)	P_D mW T_A=25°C	Package No.	Page No.
1N967B	18	5.0	21	7.0	5.0	13.7	+.085	500	DO-35	3-203
1N5248B	18	5.0	21	7.0	0.1	14	(+.085)	500	DO-35	3-213
1N4746A	18	5.0	20	14	5.0	13.7		1000	DO-41	3-211
1N5249B	19	5.0	23	6.6	0.1	14	(+.086)	500	DO-35	3-213
1N968B	20	5.0	25	6.2	5.0	15.2	+.086	500	DO-35	3-203
1N5250B	20	5.0	25	6.2	0.1	15	(+.086)	500	DO-35	3-213
1N4747A	20	5.0	22	12.5	5.0	15.2		1000	DO-41	3-211
1N969B	22	5.0	29	5.6	5.0	16.7	+.087	500	DO-35	3-203
1N5251B	22	5.0	29	5.6	0.1	17	(+.087)	500	DO-35	3-213
1N4748A	22	5.0	23	11.5	5.0	16.7		1000	DO-41	3-211
1N970B	24	5.0	33	5.2	5.0	18.2	+.088	500	DO-35	3-203
1N5252B	24	5.0	33	5.2	0.1	18	(+.088)	500	DO-35	3-213
1N4749A	24	5.0	25	10.5	5.0	18.2		1000	DO-41	3-211
1N5253B	25	5.0	5	5.0	0.1	19	(+.089)	500	DO-35	3-213
1N971B	27	5.0	41	4.6	5.0	20.6	+.090	500	DO-35	3-203
1N5254B	27	5.0	41	4.6	0.1	21	(+.090)	500	DO-35	3-213
1N4750A	27	5.0	35	9.5	5.0	20.6		1000	DO-41	3-211
1N5255B	28	5.0	44	4.5	0.1	21	(+.091)	500	DO-35	3-213
1N972B	30	5.0	49	4.2	5.0	22.8	+.091	500	DO-35	3-203
1N5256B	30	5.0	49	4.2	0.1	23	(+.091)	500	DO-35	3-213
1N4751A	30	5.0	40	8.5	5.0	22.8		1000	DO-41	3-211
1N973B	33	5.0	58	3.8	5.0	25.1	+.092	500	DO-35	3-203
1N5257B	33	5.0	58	3.8	0.1	25	(+.092)	500	DO-35	3-213
1N4752A	33	5.0	45	7.5	5.0	25.1		1000	DO-41	3-211

Tolerance: All zener diodes are also available in ± 1%, ± 2%, ± 10%, and ± 20% tolerances.

Military Qualified Transistors (Numeric Order)
Metal Packages

Device No. NPN	PNP	BV_{CEO} V	h_{FE}	@ $I_C \backslash V_{CE}$ mA/V	$V_{CE(sat)}$ V	@ $I_C \backslash I_C$ mA/mA	I_C Max. mA	Pkg. No.	Mil Std. 19500 Slash No.
2N718AJAN		30	40-120	150/10	1.5	150/15	500	TO-18	181
2N718AJANTX		30	40-120	150/10	1.5	150/15	500	TO-18	181
2N718AJANTXV		30	40-120	150/10	1.5	150/15	500	TO-18	181
2N930JAN		45	100-300	10/5.0	1.0	10/0.5	30	TO-18	253
2N930JANTX		45	100-300	10/5.0	1.0	10/0.5	30	TO-18	253
2N1613JAN		30	40-120	150/10	1.5	150/15	500	TO-39	181
2N1613JANTX		30	40-120	150/10	1.5	150/15	500	TO-39	181
2N1613JANTXV		30	40-120	150/10	1.5	150/15	500	TO-39	181
2N2218AJAN		50	40-120	150/10	0.3	150/15	800	TO-39	251
2N2218AJANTX		50	40-120	150/10	0.3	150/15	800	TO-39	251
2N2218AJANTXV		50	40-120	150/10	0.3	150/15	800	TO-39	251
2N2219AJAN		50	100-300	150/10	0.3	150/15	800	TO-39	251
2N2219AJANTX		50	100-300	150/10	0.3	150/15	800	TO-39	251
2N2219AJANTXV		50	100-300	150/10	0.3	150/15	800	TO39	251
2N2060JAN		60	50-150	10/5.0	0.3	50/5	500	TO-78	270
2N2060JANTX		60	50-150	10/5.0	0.3	50/5	500	TO-78	270
2N2221AJAN		50	40-120	150/10	0.3	150/15	800	TO-18	255
2N2221AJANTX		50	40-120	150/10	0.3	150/15	800	TO-18	255
2N2221AJANTXV		50	40-120	150/10	0.3	150/15	800	TO-18	255
2N2222AJAN		50	100-300	150/10	0.3	150/15	800	TO-18	255
2N2222AJANTX		50	100-300	150/10	0.3	150/15	800	TO-18	255
2N2222AJANTXV		50	100-300	150/10	0.3	150/15	800	TO-18	255
2N2369AJAN		15	40-120	10/0.35	0.2	10/1.0		TO-18	317
2N2369AJANTX		15	40-120	10/0.35	0.2	10/1.0		TO-18	317
2N2369AJANTXV		15	40-120	10/0.35	0.2	10/1.0		TO-18	317
2N2484JAN		60	200-500	10μA/1.0	0.3	1.0/0.1	50	TO-18	376
2N2484JANTX		60	200-500	10μA/1.0	0.3	1.0/0.1	50	TO-18	376
2N2484JANTXV		60	200-500	10μA/1.0	0.3	1.0/0.1	50	TO-18	376
	2N2904AJAN	60	40-120	150/10	0.4	150/15	600	TO-39	290
	2N2904JANTX	60	40-120	150/10	0.4	150/15	600	TO-39	290
	2N2904AJANTXV	60	40-120	150/10	0.4	150/15	600	TO-39	290
	2N2905AJAN	60	100-300	150/10	0.4	150/15	600	TO-39	290
	2N2905AJANTX	60	100-300	150/10	0.4	150/15	600	TO-39	290

Military Qualified Transistors (Numeric Order)
Metal Packages

Device No. NPN	PNP	BV_{CEO} V	h_{FE}	@ I_C\\V_{CE} mA/V	$V_{CE(sat)}$ V	@ I_C\\I_C mA/mA	I_C Max. mA	Pkg. No.	Mil Std. 19500 Slash No.
	2N2905AJANTX	60	100-300	150/10	0.4	150/15	600	TO-39	290
	2N2905AJANTXV	60	100-300	150/10	0.4	150/15	600	TO-39	290
	2N2906AJAN	60	40-120	150/10	0.4	150/15		TO-18	291
	2N2906AJANTX	60	40-120	150/10	0.4	150/15		TO-18	291
	2N2906AJANTXV	60	40-120	150/10	0.4	150/15		TO-18	291
	2N2907AJAN	60	100-300	150/10	0.4	150/15	600	TO-18	291
	2N2907AJANTX	60	100-300	150/10	0.4	150/15	600	TO-18	291
	2N2907AJANTXV	60	100-300	150/10	0.4	150/15	600	TO-18	291
2N2920JAN		60	300-1000	1.0/5.0	0.3	1.0/0.1	30	TO-78	355
2N2920JANTX		60	300-1000	1.0/5.0	0.3	1.0/0.1	30	TO-78	355
2N2920JANTXV		60	300-1000	1.0/5.0	0.3	1.0/0.1	30	TO-78	355
2N3019JAN		80	100-300	150/10	0.2	150/15		TO-39	391
2N3019JANTX		80	100-300	150/10	0.2	150/15		TO-39	391
2N3019JANTXV		80	100-300	150/10	0.2	150/15		TO-39	391
2N3700JAN		80	100-300	150/10	0.2	150/15		TO-18	391
2N3700JANTX		80	100-300	150/10	0.2	150/15		TO-18	391
2N3700JANTXV		80	100-300	150/10	0.2	150/15		TO-18	391

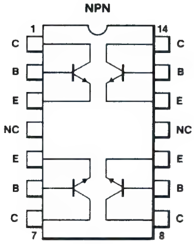
Special Quad Transistors

Plastic Package

Device No. NPN	PNP	BV_{CEO} V Min.	h_{FE} Min.	@ I_C/V_{CE} mA/V	$V_{CE(sat)}$ Max V	@ I_C/I_B mA/mA	I_C Max mA	Pkg.	Page No.
UNMATCHED									
FPQ2222		40	100	150/10	0.4	150/15	500	TO-116	3-63
	FPQ2907	40	100	150/10	0.4	150/15	500	TO-116	3-64
FPQ3724		40	30	500/1.0	0.5	500/50	1.0 A	TO-116	3-65
FPQ3725		50	20	500/1.0	0.5	500/50	1.0 A	TO-116	3-65
MPQ3725		40	200	500/1.0	0.5	500/50	1.0 A	TO-116	3-65
SWITCHING									
FPQ3904		40	100	10/1.0	0.2	10/1.0	200	TO-116	3-67
MPQ3904		40	75	10/1.0	0.2	10/1.0	200	TO-116	3-67
	FPQ3906	40	100	10/1.0	0.25	10/1.0	200	TO-116	3-69
	MPQ3906	40	75	10/1.0	0.25	10/1.0	200	TO-116	3-69
NPN DARLINGTON									
FPQ6426		30	10,000	100/5.0	1.5	100/0.1	500	TO-116	3-71
MPQ6426		30	10,000	100/5.0	1.5	100/0.1	500	TO-116	3-71
COMPLEMENTARY									
FPQ6502		40	100	150/10	0.4	150/15	500	TO-116	3-73
MPQ6502		30	100	150/10	0.4	150/15	500	TO-116	3-73
FPQ6700		40	100	10/1.0	0.25	10/1.0	200	TO-116	3-75
MPQ6700		40	70	10/1.0	0.25	10/1.0	200	TO-116	3-75

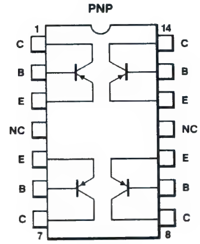
Connection Diagrams (Top View)

NPN



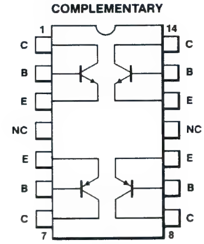
CD1

PNP



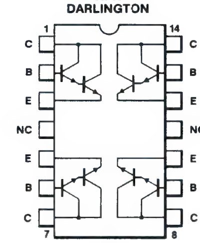
CD2

COMPLEMENTARY



CD3

NPN DARLINGTON



CD4

NPN RF Transistors (By Descending B_V) cont.

Plastic Package

Device No.	Pkg.	V_{CEO} V Min.	V_{CBO} V Min.	h_{FE}	@ mA/V I_C/V_{CE}	$V_{CE(sat)}$ V Max.	@ mA I_C/I_B
FTSO3563	TO-236	12	30	20-200	8.0/10		
FTSO5130	TO-236	12	30	15-250	8.0/10	0.6	10/1.0
MPS3563	TO-92	12	30	20-200	8.0/10		
PN3563	TO-92	12	30	20-200	8.0/10		
PN5130	TO-92	12	30	15-250	8.0/10	0.6	10/1.0
FTSO918	TO-236	15	30	20	3.0/1.0	0.4	10/1.0
MPS918	TO-92	15	30	20	10/1.0	0.4	3.0/1.0
PN918	TO-92	15	30	20	3.0/1.0	0.4	10/1.0

NPN Switches and Core Drivers (By Descending B_V)

Metal - Plastic - Packages

Device No.	Pkg.	V_{CEO} V Min.	V_{CBO} V Min.	h_{FE}	mA/V I_C/V_{CE}	$V_{CE(sat)}$ V Max.	mA I_C/I_B
2N3725	TO-39	50	80	60-150	100/1.0	0.26	100/10
2N4014	TO-18	50	80	60-150	100/1.0	0.26	100/10
2N3253	TO-39	40	75	25-75	500/1.0	0.6	500/50
2N3724	TO-39	30	50	60-150	100/1.0	0.20	100/10
2N4013	TO-18	30	50	60-150	100/1.0	0.2	100/10
FTSO2710	TO-236	20	40	40	10/1.0	0.25	10/1.0
FTSO3014	TO-236	20	40	30-120	30/0.4	0.18	30/3.0
2N2710	TO-18	20	40	40	10/1.0	0.25	10/1.0
2N3014	TO-52	20	40	30-120	30/0.4	0.18	30/3.0
FTSO706	TO-236	15	25	25	10/1.0	0.6	10/1.0
FTSO706A	TO-236	15	25	20-60	10/1.0	0.6	10/1.0
FTSO2369	TO-236	15	40	40-120	10/1.0	0.25	10/1.0
FTSO2369A	TO-236	15	40	40-120	10/0.35	0.2	10/1.0
FTSO3013	TO-236	15	40	30-120	30/0.4	0.18	30/3.0
FTSO3646	TO-236	15	40	30-120	30/0.4	0.20	30/3.0
FTSO4275	TO-236	15	40	35-120	10/1.0	0.20	10/1.0
FTSO5769	TO-236	15	40	40-120	10/0.35	0.2	10/1.0
FTSO5772	TO-236	15	40	30-120	30/0.4	0.2	30/3.0

$V_{BE(sat)}$ V Max.	@ mA I_C/I_B	C_{ob} pF Max.	f_T MHz Min.	t_{on} ns Max.	t_{off} ns Max.	NF dB	Page No.
		1.7	600	14-26			3-134
1.0	10/1.0	1.7	450				3-174
0.95	10/5.0	1.7	600	14			3-134
		1.7	600	14-26			3-134
1.0	10/1.0	1.7	450				3-174
1.0	10/1.0	1.7	600	15	30	6.0	3-134
1.0	10/1.0	1.7	600	15	30	6.0	3-134
1.0	10/1.0	1.7	600	15	30	6.0	3-134

$V_{BE(sat)}$ V Max.	mA I_C/I_B	C_{ob} pF Max.	f_T MHz Min.	t_{on} ns Max.	t_{off} ns Max.	NF dB Max.	Page No.
0.8	10/1.0	4.0	300	25	35		3-276
0.86	100/10	10	300	35	60		3-276
1.3	500/50	12	175	50	70		3-270
0.8	10/1.0	4.0	300	25	35		3-276
0.86	100/10	10	300	35	60		3-276
0.9	10/1.0	4.0	500	20	35		3-256
0.95	30/3.0	5.0	350	16	25		3-262
0.9	10/1.0	4.0	500	20	35		3-256
0.95	30/3.0	5.0	350	16	25		3-262
0.9	10/1.0	6.0	200	40	75		3-222
0.9	10/1.0	6.0	200	40	75		3-222
0.85	10/1.0	4.0	400	12	18		3-246
0.85	10/1.0	4.0	500	12	18		3-246
0.95	30/3.0	5.0	350	15	25		3-262
0.95	30/3.0	5.0	350	18	28		3-152
0.95	30/3.0	5.0	350	18	28		3-163
0.85	10/1.0	4.0	500	12	18		3-246
0.95	30/3.0	5.0	350	18	28		3-152

NPN Switches and Core Drivers (By Descending B_V)
Metal - Plastic Packages

Device No.	Pkg.	V_{CEO} V Min.	V_{CBO} V Min.	h_{FE}	mA/V I_C/V_{CE}	$V_{CE(sat)}$ V Max.	mA I_C/I_B
MPS706	TO-92	15	25	20	10/1.0	0.6	10/1.0
MPS706A	TO-92	15	25	20-60	10/1.0	0.6	10/1.0
MPS2369	TO-92	15	40	40-120	10/1.0	0.25	10/1.0
MPS3646	TO-92	15	40	30-120	30/0.4	0.20	30/3.0
PN2369	TO-92	15	40	40-120	10/1.0	0.25	10/1.0
PN2369A	TO-92	15	40	40-120	10/0.35	0.20	10/1.0
PN3646	TO-92	15	40	30-120	30/0.4	0.20	30/3.0
PN4275	TO-92	15	40	35-120	10/1.0	0.20	10/1.0
2N706	TO-18	15	25	20	10/1.0	0.6	10/1.0
2N2369	TO-18	15	40	40-120	10/1.0	0.25	10/1.0
2N2369A	TO-18	15	40	40-120	10/0.35	0.2	10/1.0
2N3013	TO-52	15	40	30-120	30/0.4	0.18	30/3.0
2N5769	TO-92	15	40	40-120	10/0.35	0.2	10/1.0
2N5772	TO-92	15	40	30-120	30/0.4	0.2	30/3.0
BSX39	TO-236	14		40-200	10/1.0	0.25	10/1.0
BSV52	TO-236	12		40-120	10/1.0	0.25	10/1.0
FTSO4274	TO-236	12	30	35-120	10/1.0	0.20	10/1.0
FTSO5224	TO-236	12	25	40-400	10/1.0	0.35	10/3.0
PN4274	TO-92	12	30	35-120	10/1.0	0.20	10/1.0
2N5224	TO-92	12	25	40-400	10/1.0	0.35	10/3.0
FTSO5134	TO-236	10	20	20-150	10/1.0	0.25	10/1.0
PN5134	TO-92	10	20	20-150	10/1.0	0.25	10/1.0

$V_{BE(sat)}$ V Max.	mA I_C/I_B	C_{ob} pF Max.	f_T MHz Min.	t_{on} ns Max.	t_{off} ns Max.	NF dB Max.	Page No.
0.9	10/1.0	6.0	200	40	75		3-222
0.9	10/1.0	6.0	200	40	75		3-222
0.85	10/1.0	4.0	500	12	18		3-246
0.95	30/3.0	5.0	350	18	28		3-152
0.85	10/1.0	4.0	400	12	12		3-246
0.85	10/1.0	4.0	400	12	12		3-246
0.85	10/1.0	4.0	500	12	18		3-152
0.95	30/3.0	5.0	350	18	28		3-163
0.9	10/1.0	6.0	200				3-222
0.85	10/1.0	4.0	400	12	18		3-246
0.85	10/1.0	4.0	500	12	18		3-246
0.95	30/3.0	5.0	350	15	25		3-261
0.85	10/1.0	4.0	500	12	18		3-246
0.95	30/3.0	5.0	350	18	25		3-152
0.85	10/1.0			12	18		3-47
0.85	10/1.0	4.0	400	12	18		3-46
0.95	30/3.0	5.0	350	16	25		3-163
0.9	10/3.0	4.0	250	45	60		3-318
0.95	30/3.0	5.0	350	16	25		3-163
0.9	10/3.0	4.0	250	45	60		3-318
0.9	10/1.0	4.0	250	18	18		3-177
0.9	10/1.0	4.0	250	18	18		3-177

PNP Switches and Core Drivers (By Descending B_V)

Metal - Glass Packages

Device No.	Pkg.	V_{CEO} V Min.	V_{CBO} V Min.	h_{FE}	mA/V I_C/V_{CE}	$V_{CE(sat)}$ V Max.	mA I_C/I_B
FTSO5228	TO-236	-5.0	-5.0	30	10/0.3	-0.4	10/3.0
2N5228	TO-92	-5.0	-5.0	30	10/0.3	-0.4	10/3.0
FTSO3639	TO-236	-6.0	-6.0	30-120	10/0.3	-0.16	10/1.0
MPS3639	TO-92	-6.0	-6.0	30-120	10/0.3	-0.16	10/1.0
PN3639	TO-92	-6.0	-6.0	30-120	10/0.3	-0.16	10/1.0
FTSO3640	TO-236	-12	-12	30-120	10/0.3	-0.2	10/1.0
FTSO4208	TO-236	-12	-12	30-120	10/0.3	-0.15	10/1.0
FTSO4258	TO-236	-12	-12	30-120	10/3.0	-0.15	10/1.0
MPS3640	TO-92	-12	-12	30-120	10/0.3	-0.2	10/1.0
PN3640	TO-92	-12	-12	30-120	10/0.3	-0.2	10/1.0
PN4258	TO-92	-12	-12	30-120	10/3.0	-0.15	10/1.0
2N4208	TO-18	-12	-12	30-120	10/0.3	-0.15	10/1.0
FTSO5771	TO-236	-15	-15	50-120	10/0.3	-0.18	10/1.0
2N4209	TO-18	-15	-15	50-120	10/0.3	-0.18	10/1.0
2N5771	TO-92	-15	-15	50-120	10/0.3	-0.18	10/1.0

NPN General Purpose Amplifiers (By Descending B_V)

Metal - Glass Packages

Device No.	Pkg.	V_{CEO} V Min.	V_{CBO} V Min.	h_{FE}	mA/V I_C/V_{CE}	$V_{CE(sat)}$ V Max.	mA I_C/I_B
FTSOA42	TO-236	300	300	40	30/10	0.5	20/2.0
MPSA42	TO-92	300	300	40	30/10	0.5	20/2.0
PE7059	TO-92	300	300	40	30/20	1.0	20/2.0
PE7058	TO-92	220	220	40	30/20	1.0	20/2.0
FTSOA43	TO-236	200	200	50-200	30/10	0.4	20/2.0
MPSA43	TO-92	200	200	50-200	30/10	0.4	20/2.0
FTSO5965	TO-236	180	200	50-250	10/5.0	0.2	10/1.0
FTSO5833	TO-236	180	200	50-250	10/5.0	0.2	10/1.0
PN5965	TO-92	180	200	50-250	10/5.0	0.2	10/1.0
2N5833	TO-92	180	200	50-250	10/5.0	0.2	10/1.0
2N5550	TO-92	140	160	60-250	10/5.0	0.15	10/1.0

$V_{BE(sat)}$ V Max.	mA I_C/I_B	C_{ob} pF Max.	f_T MHz Min.	t_{on} ns Max.	t_{off} ns Max.	NF dB Max.	Page No.
-1.25	10/3.0	5.0	300	75	140		3-323
-1.25	10/3.0	5.0	300	75	140		3-323
-1.0	10/1.0	3.5	500	60	60		3-144
-1.0	10/1.0	3.5	500	60	60		3-144
-1.0	10/1.0	3.5	500	60	60		3-144
-1.0	10/1.0	3.5	500	60	75		3-144
-0.95	10/1.0	3.0	700	15	20		3-295
-0.95	10/1.0	3.0	700	15	20		3-161
-1.0	10/1.0	3.5	500	60	75		3-144
-1.0	10/1.0	3.5	500	60	75		3-144
-0.95	10/1.0	3.0	700	15	20		3-161
-0.95	10/1.0	3.0	700	15	20		3-295
-0.95	10/1.0	3.0	850	15	20		3-338
-0.95	10/1.0	3.0	850	15	20		3-295
-0.95	10/1.0	3.0	850	15	20		3-338

$V_{BE(sat)}$ V Max.	mA I_C/I_B	C_{ob} pF Max.	f_T MHz Min.	t_{on} MHz Min.	t_{off} ns Max.	NF ns Max.	Page No.
0.9	20/2.0	3.0	50				3-119
0.9	20/2.0	3.0	50				3-119
0.85	20/2.0	4.0	40				3-130
0.85	20/2.0	4.0	40				3-130
0.9	20/2.0	4.0	50				3-119
0.9	20/2.0	4.0	50				3-119
1.0	10/1.0	4.0	100				3-192
1.0	10/1.0	4.0	100				3-340
1.0	10/1.0	4.0	100				3-192
1.0	10/1.0	4.0	100				3-340
1.0	10/1.0	6.0	100			10	3-333

NPN General Purpose Amplifiers (By Descending B_V) continued

Metal - Glass Packages

Device No.	Pkg.	V_{CEO} V Min.	V_{CBO} V Min.	h_{FE}	mA/V I_C/V_{CE}	$V_{CE(sat)}$ V Max.	mA I_C/I_B
2N5831	TO-92	140	160	80-250	10/5.0	0.2	10/1.0
FTSO5551	TO-236	160	180	80-250	10/5.0	0.15	10/1.0
MPS5551	TO-92	160	180	80-250	10/5.0	0.15	10/1.0
FTSO5550	TO-236	140	160	60-250	10/5.0	0.15	10/1.0
FTSO5831	TO-236	140	160	80-250	10/5.0	0.2	10/1.0
FTSOL01	TO-236	120	140	50-300	10/5.0	0.2	10/1.0
MPSL01	TO-92	120	140	50-300	10/5.0	0.2	10/1.0
FTSO5830	TO-236	100	120	80-500	10/5.0	0.2	10/1.0
2N5830	TO-92	100	120	80-500	10/5.0	0.2	10/1.0
2N2405	TO-39	90	120	60-200	150/10	0.5	150/15
BSS64	TO-236	80	120	20	1.0/10	0.7	4.0/0.4
FTSO4410	TO-236	80	120	60-400	10/1.0	0.2	1.0/0.1
2N1893	TO-39	80	120	40-120	150/10	5.0	150/15
2N3019	TO-39	80	140	100-300	150/10	0.20	150/15
2N3020	TO-39	80	140	40-120	150/10	0.20	150/15
2N3700	TO-18	80	140	100-300	150/10	0.2	150/15
2N3701	TO-18	80	140	40-120	150/10	0.2	150/15
2N4410	TO-92	80	120	60-400	10/1.0	0.2	1.0/0.1
FTSO2484	TO-236	60	60	100-500	10μA/5.0	0.35	1.0/0.1
FTSO3117	TO-236	60	60	250-500	10μA/5.0	0.35	1.0/0.1
FTSO5961	TO-236	60	60	150-700	10/5.0	0.2	10/0.5
PE4020	TO-92	60	60	150-950	10/5.0	0.2	10/0.5
PN2484	TO-92	60	60	100-500	10μA/5.0	0.35	1.0/0.1
2N1890	TO-39	60	100	100-300	150/10	5.0	150/15
2N2484	TO-18	60	60	100-500	10μA/5.0	0.35	1.0/0.1
2N3107	TO-39	60	100	100-300	150/1.0	0.25	150/15
2N3108	TO-39	60	100	40-120	150/1.0	0.25	150/15
2N3117	TO-18	60	60	250-500	10μA/5.0	0.35	1.0/0.1
2N5961	TO-92	60	60	150-700	10/5.0	0.2	10/0.5
FTSO4409	TO-236	50	80	60-400	10/1.0	0.2	1.0/0.1
FTSO5209	TO-236	50	50	100-300	100μA/5.0	0.7	10/1.0
FTSO5210	TO-236	50	50	200-600	100μA/5.0	0.7	10/1.0
2N3053	TO-39	50	60	50-250	150/10	1.4	150/15

$V_{BE(sat)}$ V Max.	mA I_C/I_B	C_{ob} pF Max.	f_T MHz Min.	t_{on} ns Max.	t_{off} ns Max.	NF dB Max.	Page No.
1.0	10/1.0	4.0	100				3-340
1.0	10/1.0	6.0	100			8.0	3-333
1.0	10/1.0	6.0	100			8.0	3-333
1.0	10/1.0	6.0	100			10	3-333
1.0	10/1.0	4.0	100				3-340
1.2	10/1.0	8.0	60				3-125
1.2	10/1.0	8.0	60				3-125
1.0	10/1.0	6.0	100				3-340
1.0	10/1.0	6.0	100				3-340
1.1	150/15	15					3-249
			50				3-43
0.8	1.0/0.1	12	60				3-305
1.3	150/15	15	50				3-234
1.1	150/15	12	100			4.0	3-264
1.1	150/15	12	80				3-264
1.1	150/15	12	100			4.0	3-274
1.1	150/15	12	80				3-274
0.8	1.0/0.1	12	60				3-301
		6.0	60			3.0	3-251
		4.5	60			4.0	3-251
		4.0	100				3-343
		4.0	100			6.0	3-128
		6.0	60			3.0	3-251
1.3	150/15	15	60				3-232
		6.0	60			3.0	3-251
1.1	150/15	20	70	200	1000	7.0	3-267
1.1	150/15	20	60	200	600	7.0	3-267
		4.5	60			4.0	3-251
		4.0	100				3-343
0.8	1.0/0.1	12	60				3-305
		4.0	30				3-313
		4.0	30				3-313
1.7	150/15	15	100				3-266

NPN General Purpose Amplifiers (By Descending B_V) continued

Metal - Glass Packages

Device No.	Pkg.	V_{CEO} V Min.	V_{CBO} V Min.	h_{FE}	mA/V I_C/V_{CE}	$V_{CE(sat)}$ V Max.	mA I_C/I_B
2N4409	TO-92	50	80	60-400	10/1.0	0.2	1.0/0.1
2N5209	TO-92	50	50	100-300	100μA/5.0	0.7	10/1.0
2N5210	TO-92	50	50	200-600	100μA/5.0	0.7	10/1.0
FTSO3693	TO-236	45	45	40-160	10/10		
FTSO3694	TO-236	45	45	100-400	10/10		
FTSO5962	TO-236	45	45	600-1400	0/5.0	0.2	10/0.5
MPSA18	TO-92	45	45	500-1500	10/5.0	0.3	50/5.0
PN930	TO-92	45	45	100-300	10μA/5.0	1.0	10/0.5
PN3642	TO-92	45	60	40-120	150/10	0.22	150/15
PN3693	TO-92	45	45	40-160	10/10		
PN3694	TO-92	45	45	100-400	10/10		
2N930	TO-18	45	45	100-300	10μA/5.0	1.0	10/0.5
2N930A	TO-18	45	60	100-300	10μA/5.0	0.5	10/0.5
2N2270	TO-39	45	60	50-200	150/10	0.9	150/15
2N2586	TO-18	45	60	120-360	10μA/5.0	0.5	5.0/0.5
2N5962	TO-92	45	45	600-1400	10/5.0	0.2	10/0.5
BCW66F	TO-236	45	75	100-250	100/1.0		
BCW72	TO-236	45	50	200-450	2.0/5.0	0.25	10/0.5
BCX70G	TO-236	45	45	120-220	2.0/5.0	0.35	10/0.25
BCX70H	TO-236	45	45	180-310	2.0/5.0	0.35	10/025
BCX70J	TO-236	45	45	250-460	2.0/5.0	0.35	10/0.25
BCF81	TO-236	45	50	420-800	2.0/5.0	0.25	10/0.5
BCW81	TO-236	45	50	420-800	2.0/5.0	0.25	10./0.5
FTSO930	TO-236	45	45	100-300	10μA/5.0	1.0	10/0.5
FTSO930A	TO-236	45	60	100-300	10μA/5.0	0.5	10/0.5
FTSO3642	TO-236	45	60	40-120	150/10	0.22	150/15
BSR14	TO-236	40	75	100-300	150/10	0.3	150/15
BSR17	TO-236	40	60	50-150	10/1.0	0.2	10/1.0
BSS79B	TO-236	40	75	40-120	150/10	0.3	150/15
BSS79C	TO-236	40	75	100-300	150/10	0.3	150/15
FTSOA20	TO-236	40		40-400	5.0/10	0.25	10/1.0
FTSO2218A	TO-236	40	75	40-120	150/10	0.3	150/15
FTSO2219A	TO-236	40	75	100-300	150/10	0.3	150/15
FTSO2221A	TO-236	40	75	40-120	150/10	0.3	150/15

$V_{BE(sat)}$ V Max.	mA I_C/I_B	C_{ob} pF Max.	f_T MHz Min.	t_{on} ns Max.	t_{off} ns Max.	NF dB Max.	Page No.
0.8	1.0/0.1	12	60				3-305
		4.0	30				3-313
		4.0	30				3-313
		3.5	200				3-154
		3.5	200				3-154
		4.0	100				3-343
		3.0	100			1.5	3-116
1.0	10/0.5	8.0	30				3-226
		8.0	150				3-147
		3.5	200				3-154
		3.5	200				3-154
1.0	10/0.5	8.0	30				3-226
0.9	10/0.5	3.0	45				3-228
1.2	150/15	15	100				3-244
0.9	5.0/0.5	7.0	45			3.0	3-254
		4.0	100				3-343
2.0	500/50	12	100	100	400	10	3-28
		4.0				10	3-30
0.85	50/0.25	4.5	125	150	800	6.0	3-32
0.85	50/0.25	4.5	125	150	800	6.0	3-32
0.85	50/0.25	4.5	125	150	800	6.0	3-32
		4.0				4.0	3-21
		4.0				10	3-31
1.0	10/0.5	8.0	30				3-226
0.9	10/0.5	3.0	45				3-228
		8.0	150				3-147
1.2	150/15	8.0	300	35	285		3-36
0.85	10/1.0		250				3-40
		8.0	250	20	285		3-44
		8.0	250	20	285		3-44
		4.0	125				3-118
1.2	150/15	8.0	250	35	285		3-238
1.2	150/15	8.0	300	35	285	4.0	3-242
1.2	150/15	8.0	250	3	285		3-238

NPN General Purpose Amplifiers (By Descending B_V) continued

Metal - Glass Packages

Device No.	Pkg.	V_{CEO} V Min.	V_{CBO} V Min.	h_{FE}	mA/V I_C/V_{CE}	$V_{CE(sat)}$ V Max.	mA I_C/I_B
FTSO2222A	TO-236	40	75	100-300	150/10	0.3	150/15
FTSO3567	TO-236	40	80	40-120	150/1.0	0.25	150/15
FTSO3569	TO-236	40	80	100-300	150/1.0	0.25	150/15
FTSO3903	TO-236	40	60	50-150	10/1.0	0.2	10/1.0
FTSO3904	TO-236	40	60	100-300	10/1.0	0.2	10/1.0
FTSO3946	TO-236	40	60	59-150	10/1.0	0.2	10/1.0
FTSO4400	TO-236	40	60	50-150	150/1.0	0.4	150/15
FTSO4401	TO-236	40	60	100-300	150/1.0	0.4	150/15
MPSA10	TO-92	40		40-400	5.0/10		
MPSA20	TO-92	40		40-400	5.0/10	0.25	10/1.0
PN2218A	TO-92	40	75	40-120	150/10	0.3	150/15
PN2219A	TO-92	40	75	100-300	150/10	0.3	150/15
PN2221A	TO-92	40	75	40-120	150/10	0.3	150/15
PN2222A	TO-92	40	45	100-300	150/10	0.3	150/15
PN3567	TO-92	40	80	40-120	150/1.0	0.25	150/15
PN3569	TO-92	40	80	100-300	150/1.0	0.25	150/15
2N697	TO-39	40	60	40-120	150/10	1.5	150/15
2N2218A	TO-39	40	75	40-120	150/10	0.3	150/15
2N2219A	TO-39	40	75	100-300	150/10	0.3	150/15
2N2221A	TO-18	40	75	40-120	150/10	0.3	150/15
2N2222A	TO-18	40	75	100-300	150/10	0.3	150/15
2N3109	TO-39	40	80	100-300	150/1.0	0.25	150/15
2N3903	TO-92	40	60	50-150	10/1.0	0.2	10/1.0
2N3904	TO-92	40	60	100-300	10/1.0	0.2	10/1.0
2N3946	TO-18	40	60	59-150	10/1.0	0.2	10/1.0
2N4400	TO-92	40	60	50-150	150/1.0	0.4	150/15
2N4401	TO-92	40	60	100-300	150/1.0	0.4	150/15
BCW60A	TO-236	32	32	120-200	2.0/5.0	0.35	10/0.25
BCW65A	TO-236	32	60	100-250	100/1.0		
2N1613	TO-39	32	75	40-120	150/10	1.5	150/15
BSR13	TO-236	30	60	100-300	150/10	0.4	150/15
FTSO2218	TO-236	30	60	40-120	150/10	0.4	150/15
FTSO2219	TO-236	30	60	100-300	150/10	0.4	150/15

$V_{BE(sat)}$ V Max.	mA I_C/I_B	C_{ob} pF Max.	f_T MHz Min.	t_{on} ns Max.	t_{off} ns Max.	NF dB Max.	Page No.
1.2	150/15	8.0	300	35	285		3-242
1.1	150/15	20	56				3-140
1.1	150/15	20	60				3-140
0.85	10/1.0	4.0	250	70	225	6.0	3-278
0.85	10/1.0	4.0	300	70	250	5.0	3-278
0.9	10/1.0	4.0	250	335	375	5.0	3-282
0.95	150/15	6.5	200	35	255		3-301
0.95	150/15	6.5	250	35	255		3-301
		4.0	50				3-112
		4.0	125				3-118
1.2	150/15	8.0	250	35	285		3-238
1.2	150/15	8.0	300	35	285	4.0	3-242
1.2	150/15	8.0	250	35	285		3-238
1.2	150/15	8.0	300	35	285		3-242
1.1	150/15	20	60				3-140
1.1	150/15	20	60				3-140
1.3	150/15	35	50				3-221
1.2	150/15	8.0	250				3-238
1.2	150/15	8.0	300	35	250		3-242
1.2	150/15	8.0	250	35	285		3-238
1.2	150/15	8.0	300	35	285		3-242
1.1	150/15	25	70	200	1000	7.0	3-267
0.85	10/1.0	4.0	250	70	225	6.0	3-278
0.85	10/1.0	4.0	300	70	250	5.0	3-278
0.9	10/1.0	4.0	250	335	375	5.0	3-282
0.95	150/15	6.5	200	35	255		3-301
0.95	150/15	6.5	250	35	2255		3-301
0.85	50/0.25	4.5	125	150	800	6.0	3-24
2.0	500/50	12	100	100	400	10	3-27
1.3	150/15	25	60			12	3-224
1.3	150/15	8.0	250				3-36
1.3	150/15	8.0	250				3-236
1.3	150/15	8.0	250				3-240

NPN General Purpose Amplifiers (By Descending V_V)
Metal - Plastic Package

Device No.	Pkg.	V_{CEO} V Min.	V_{CBO} V Min.	h_{FE}	mA/V I_C/V_{CE}	$V_{CE(sat)}$ V Max.	mA I_C/I_B
FTSO2221	TO-236	30	60	40-120	150/10	0.4	150/15
FTSO2222	TO-236	30	60	100-300	150/10	0.4	150/15
FTSO3566	TO-236	30	40	150-600	10/10	1.0	100/10
FTSO3641	TO-236	30	60	40-120	150/10	0.22	150/15
FTSO3643	TO-236	30	60	100-300	150/10	0.22	150/15
FTSO3704	TO-236	30	50	100-300	50/2.0	0.6	100/5.0
FTSO3705	TO-236	30	50	50-150	50/2.0	0.8	100/5.0
FTSO4123	TO-236	30	40	5-150	2.0/1.0	0.3	50/5.0
FTSO5088	TO-236	30	35	300-900	100μA/5.0	0.5	10/1.0
MPS3704	TO-92	30	50	100-300	50/2.0	0.6	100/5.0
MPS3705	TO-92	30	50	50-150	50/2.0	0.8	100/5.0
PN2218	TO-92	30	60	40-120	150/10	0.4	150/15
PN2219	TO-92	30	60	100-300	150/10	0.4	150/15
PN2221	TO-92	30	60	40-120	150/10	0.4	150/15
PN2222	TO-92	30	60	100-300	150/10	0.4	150/15
PN3566	TO-92	30	40	150-600	10/10	1.0	100/10
PN3641	TO-92	30	60	40-120	150/10	0.22	150/15
PN3643	TO-92	30	60	100-300	150/10	0.22	150/15
2N2218	TO-39	30	60	40-120	150/10	0.4	150/15
2N2219	TO-39	30	60	100-300	150/10	0.4	150/15
2N2221	TO-18	30	60	40-120	150/10	0.4	150/15
2N2222	TO-18	30	60	100-300	150/10	0.4	150/5
2N4123	TO-92	30	40	50-150	2.0/1.0	0.3	50/5.0
2N5088	TO-92	30	35	300-900	100μA/5.0	0.5	10/1.0
FTSO2924	TO-236	25	25				
FTSO3392	TO-236	25	25	150-300	2.0/4.5		
FTSO3393	TO-236	25	25	90-180	2.0/4.5		
FTSO3565	TO-236	25	30	150-600	1.0/10	0.35	100/0.1
FTSO4124	TO-236	25	30	120-360	2.0/1.0	0.3	50/5.0
FTSO5089	TO-236	25	30	400-1200	100μA/5.0	0.5	10/1.0
FTSO5135	TO-236	25	30	50-600	10/10	1.0	100/10
FTSO5172	TO-236	25	25	100-500	10/10	0.25	10/1.0
FTSO5225	TO-236	25	25	30-600	50/10	0.8	100/10

$V_{BE(sat)}$ V Max.	mA I_C/I_B	C_{ob} pF Max.	f_T MHz Min.	t_{on} ns Max.	t_{off} ns Max.	NF dB Max.	Page No.
1.3	150/15	8.0	250				3-236
1.3	150/15	8.0	250				3-240
		25	40				3-138
		8.0	150				3-147
		8.0	250				3-147
		12	100				3-99
		12	100				3-99
0.95	50/5.0	4.0	250			6.0	3-291
		4.0	50				3-311
		12	100				3-99
		12	100				3-99
1.3	150/15	8.0	250				3-236
1.3	150/15	8.0	250				3-240
1.3	150/15	8.0	250				3-236
1.3	150/15	8.0	250				3-240
		25	40				3-138
		8.0	150				3-147
		8.0	250				3-147
1.3	150/15	8.0	250				3-236
1.3	150/15	8.0	250				3-240
1.3	150/15	8.0	250				3-236
1.3	150/15	8.0	250				3-240
0.95	50/5.0	4.0	250			6.0	3-291
		4.0	50				3-311
		12					3-94
		10					3-95
		10					3-95
		4.0	40				3-137
0.95	50/5.0	4.0	300			5.0	3-291
		4.0	50				3-311
1.0	100/10	25	40				3-179
		10					3-101
1.0	100/10	20	50				3-320

NPN General Purpose Amplifiers (By Descending V_V)
Metal - Plastic Package

Device No.	Pkg.	V_{CEO} V Min.	V_{CBO} V Min.	h_{FE}	mA/V I_C/V_{CE}	$V_{CE(sat)}$ V Max.	mA I_C/I_B
FTSO6514	TO-236	25	40	150-200	2.0/10	0.5	50/5.0
FTSO6515	TO-236	25	40	250-500	2.0/10	0.5	50/5.0
FTSO6520	TO-236	25	40	200-400	2.0/10	0.5	50/5.0
FTSO6521	TO-236	25	40	300-600	2.0/10	0.5	50/5.0
FTSO6560	TO-236	25	25	50-200	500/1.0	0.5	500/50
MPS2924	TO-92	25	25				
MPS3392	TO-92	25	25	150-300	2.0/4.5		
MPS3393	TO-92	25	25	90-180	2.0/4.5		
MPS5172	TO-92	25	25	100-500	10/10	0.25	10/1.0
MPS6514	TO-92	25	40	150-300	2.0/10	0.5	50/5.0
MPS6515	TO-92	25	40	250-500	2.0/10	0.5	50/5.0
MPS6520	TO-92	25	40	200-400	2.0/10	0.5	50/5.0
MPS6521	TO-92	25	40	300-600	2.0/10	0.5	50/5.0
MPS6560	TO-92	25	25	50-200	500/1.0	0.5	500/50
PE4010	TO-92	25	30	200-1000	1.0/10	0.35	1.0/0.1
PE8050	TO-92	25	30	65-200	100/1.0	0.15	200/20
PN3565	TO-92	25	30	150-600	1.0/10	0.35	1.0/0.1
PN5135	TO-92	25	30	50-600	10/10	1.0	100/10
2N4124	TO-92	25	30	120-360	2.0/1.0	0.3	50/5.0
2N5089	TO-92	25	30	400-1200	100μA/5.0	0.5	10/1.0
2N5225	TO-92	25	25	30-600	50/10	0.8	100/10
BCW32	TO-236	20	30	200-450	2.0/5.0	0.25	10/0.5
BCW33	TO-236	20	30	420-800	2.0/5.0	0.25	10/0.5
FTSO5136	TO-236	20	30	20-400	150/1.0	0.25	150/15
FTSO5137	TO-236	20	30	20-400	150/1.0	0.25	150/15
FTSO5223	TO-236	20	25	50-800	2.0/10	0.7	10/1.0
FTSO6561	TO-236	20	20	50-200	350/1.0	0.5	350/35
FTSO6571	TO-236	20	25	250-1,000	0.1/5.0	0.5	10/1.0
MPS6561	TO-92	20	20	50-200	350/1.0	0.5	350/35
MPS6571	TO-92	20	25	250-1,000	0.1/5.0	0.5	10/1.0
PN5136	TO-92	20	30	20-400	150/1.0	0.25	150/15
PN5137	TO-92	20	30	20-400	150/1.0	0.25	150/15
2N5223	TO-92	20	25	50-800	2.0/10	0.7	10/1.0

Transistor Shortform Data

$V_{BE(sat)}$ V Max.	mA I_C/I_B	C_{ob} pF Max.	f_T MHz Min.	t_{on} ns Max.	t_{off} ns Max.	NF dB Max.	Page No.
		3.5					3-102
		3.5					3-102
		3.5				3.0	3-104
		3.5				3.0	3-104
		30	60				3-107
		12					3-94
		10					3-95
		10					3-95
		10					3-101
		3.5					3-102
		3.5					3-102
		3.5				3.0	3-104
		3.5				3.0	3-104
		30	60				3-107
	4.0	60					3-127
0.9	200/20	40	100				3-132
		4.0	40				3-137
1.0	100/10	25	40				3-179
0.95	50/5.0	4.0	300			5.0	3-291
		4.0	50				3-311
1.0	100/10	20	50				3-320
		4.0				10	3-23
		4.0				10	3-23
1.1	150/15	35	40				3-179
1.1	150/15	35	40				3-179
1.2	10/1.0	4.0	150				3-316
		30	60				3-107
		4.5	50				3-109
0.5	350/35			30	60		3-107
0.5	10/1.0			4.5	50		3-109
0.25	150/15	1.1	150/15	35	40		3-179
0.25	150/15	1.1	150/15	35	40		3-179
0.7	10/1.0	1.2	10/1.0	4.0	150		3-316

NPN General Purpose Amplifiers (By Descending V_V)

Metal - Plastic Package

Device No.	Pkg.	V_{CEO} V Min.	V_{CBO} V Min.	h_{FE}	mA/V I_C/V_{CE}	$V_{CE(sat)}$ V Max.	mA I_C/I_B
FTSO5133	TO-236	18	20	60-000	1.8/5.0	0.4	1.0/0.1
PN5133	TO-92	18	20	60-1000	1.8/5.0	0.4	1.0/0.1
FTSO5220	TO-236	15	15	30-600	50/10	0.5	150/15
2N5220	TO-92	15	15	30-600	50/10	0.5	150/15
FTSO4274	TO-236	12	30	35-120	10/1.0	0.20	10/1.0
FTSO5128	TO-236	12	15	35-350	50/10	0.25	150/15
PN5128	TO-92	12	15	35-350	50/10	0.25	150/15
FTSO5134	TO-236	10	20	20-150	10/1.0	0.25	10/1.0
FTSOA12	TO-236		20	20,000	10/5.0	1.0	10/0.01
FTSOA13	TO-236		30	10,000	100/5.0	1.5	100/0.1
FTSOA14	TO-236		30	20,000	100/5.0	1.5	100/0.1
MPSA12	TO-92		20	20,000	10/5.0	1.0	10/0.01
MPSA13	TO-92		30	10,000	100/5.0	1.5	100/0.1
MPSA14	TO-92		30	20,000	100/5.0	1.5	100/0.01
2N718A	TO-18		75	40-120	150/10	1.5	150/15

PNP General Purpose Amplifiers (By Ascending B_V)

Metal - Glass Packages

Device No.	Pkg.	V_{CEO} V Min.	V_{CBO} V Min.	h_{FE}	mA/V I_C/V_{CE}	$V_{CE(sat)}$ V Max.	mA I_C/I_B
BCW29	TO-236	-20	-30	120-260	2.0/5.0	-0.3	10/0.5
BCW30	TO-236	-20	-30	215-500	2.0/5.0	-0.3	10/0.5
FTSO5139	TO-236	-20	-20	40	10/-1.0	-0.2	10/1.0
FTSO5142	TO-236	-20	-20	30	50/-1.0	-0.5	50/2.5
FTSO5143	TO-236	-20	-20	15	300/-10	-2.0	300/30
PN5139	TO-92	-20	-20	40	10/-1.0	-0.2	10/1.0
PN5142	TO-92	-20	-20	30	50/-1.0	-0.5	50/2.5
PN5143	TO-92	-20	-20	15	300/-10	-2.0	300/30
FTSO3638	TO-236	-25	-25	30	50/-1.0	-0.25	50/2.5
FTSO3638A	TO-236	-25	-25	100	50/-1.0	-0.25	50/2.5
FTSO3702	TO-236	-25	-40	60-300	50/-5.0	-0.25	50/5.0
FTSO4126	TO-236	-25	-25	120-360	2.0/-1.0	-0.4	50/5.0

$V_{BE(sat)}$ V Max.	mA I_C/I_B	C_{ob} pF Max.	f_T MHz Min.	t_{on} ns Max.	t_{off} ns Max.	NF dB Max.	Page No.
		5.0	40				3-176
		5.0	40				3-176
1.1	150/15	10	100				3-315
1.1	150/15	10	100				3-315
0.95	30/3.0	5.0	350	16	25		3-163
1.1	150/15	10	200				3-172
1.1	150/15	10	200				3-172
0.9	10/1.0	4.0	250	18	18		3-177
							3-113
			125				3-114
			125				3-114
							3-113
			125				3-114
			125				3-114
1.3	150/15	25	60			12	3-224

$V_{BE(sat)}$ V Max.	C_{ob} mA I_C/I_B	f_T pF Max.	t_{on} MHz Min.	t_{off} ns Max.	NF ns Max.	dB Max.	Page No.
		7.0				10	3-22
		7.0				10	3-22
-1.0	10/1.0	5.0	300				3-184
-1.5	50/2.5	10	100	100	200		3-186
-2.5	300/30	10	100	100	200		3-186
-1.0	10/1.0	5.0	300				3-184
-1.5	50/2.5	10	100	100	200		3-186
-2.5	300/30	10	100	100	200		3-186
-1.1	50/2.5	20	100	75	170		3-142
-1.1	50/2.5	10	150	75	170		3-142
		12	100				3-97
-0.95	50/5.0	4.5	250			4.0	3-293

PNP General Purpose Amplifiers (By Ascending B_V) continued

Metal - Glass Packages

Device No.	Pkg.	V_{CEO} V Min.	V_{CBO} V Min.	h_{FE}	mA/V I_C/V_{CE}	$V_{CE(sat)}$ V Max.	mA I_C/I_B
FTSO5226	TO-236	-25	-25	0-600	50/-10	-0.8	100/10
FTSO6562	TO-236	-25	-25	50-200	500/-1.0	-0.5	500/50
PN3638	TO-92	-25	-25	30	50/-1.0	-0.25	50/2.5
PN3638A	TO-92	-25	-	100	50/-1.0	-0.25	50/2.5
2N4126	TO-92	-25	-25	120-360	2.0/-1.0	-0.4	50/5.0
2N5226	TO-92	-25	-25	30-600	50/-10	-0.8	100/10
FTSO3703	TO-236	-30	-50	30-150	50/-5.0	-0.25	50/5.0
FTSO3704	TO-236	-30	-50	100-300	50/2.0	-0.6	100/5.0
FTSO3705	TO-236	-30	-50	50-150	50/2.0	-0.8	100/5.0
FTSO4125	TO-236	-30	-30	50-150	2.0/-1.0	-0.4	50/5.0
FTSO4916	TO-236	-30	-30	70-200	10/-1.0	-0.14	10/1.0
FTSO4917	TO-236	-30	-30	150-300	10/-1.0	-0.14	10/1.0
FTSO5138	TO-236	-30	-30	50-800	0.1/-10	-0.3	10/0.5
FTSO5227	TO-236	-30	-30	50-700	2.0/-10	-0.4	10/1.0
PN4916	TO-92	-30	-30	70-200	10/-1.0	-0.14	10/1.0
PN4917	TO-92	-30	-30	150-300	10/-1.0	-0.14	10/1.0
PN5138	TO-92	-30	-30	50-800	0.1/-10	-0.3	10/0.5
2N4125	TO-92	-30	-30	50-150	2.0/-1.0	-0.4	50/5.0
2N5227	TO-92	-30	-90	50-700	2.0/-10	-0.4	10/1.0
BCW61A	TO-236	-32	-32	120-220	2.0/5.0	-0.25	10/0.25
BCF29	TO-236	-32	-32	120-260	2.0/5.0	-0.3	10/0.50
BCF30	TO-236	-32	-32	215-500	2.0/5.0	-0.3	10/0.50
BSR15	TO-236	-40	-60	100-300	150/10	-0.4	150/15
BSS80B	TO-236	-40	-75	40-120	150/10	-0.3	150/15
BSS80C	TO-236	-40	-60	100-300	150/10	-0.4	150/15
FTSO2904	TO-236	-40	-60	40-120	150/-10	-0.4	150/15
FTSO2905	TO-236	-40	-60	100-300	150/-10	-0.4	150/15
FTSO2906	TO-236	-40	-60	40-120	150/-10	-0.4	150/15
FTSO2907	TO-236	-40	-60	100-300	150/-10	-0.4	150/15
FTSO3251	TO-236	-40	-50	100-300	10/-1.0	-0.25	10/1.0
FTSO3905	TO-236	-40	-40	50-150	10/-1.0	-0.25	10/1.0

$V_{BE(sat)}$ V Max.	mA I_C/I_B	C_{ob} pF Max.	f_T MHz Min.	t_{on} ns Max.	t_{off} ns Max.	NF dB Max.	Page No.
-1.0	100/10	20	50				3-320
		30	60				3-107
-1.1	50/2.5	20	100	75	170		3-142
-1.1	50/2.5	10	150	75	170		3-142
-0.95	50/5.0	4.5	250			4.0	3-292
-1.0	100/10	20	50				3-320
-0.9	150/15	30	100	100	400	3.0	3-97
		12	100				3-99
		12	100				3-99
-0.95	50/5.0	4.5	200			5.0	3-293
-0.9	10/1.0	4.5	400	40	150	6.0	3-170
-0.9	10/1.0	4.5	450	40	150	6.0	3-170
-1.0	10/0.5	7.0	30				3-182
-1.0	10/1.0	5.0	100				3-322
-0.9	10/1.0	4.5	400	40	150	6.0	3-170
-0.9	10/1.0	4.5	450	40	150	6.0	3-170
-1.0	10/0.5	7.0	30				3-182
-0.95	50/5.0	4.5	200			5.0	3-293
-1.0	10/1.0	5.0	100				3-322
-0.85	10/0.25	6.0		150	800	6.0	3-26
		7.0					3-19
		7.0					3-19
-1.3	150/15	8.0	200	45	100		3-38
		8.0	250	20	285		3-45
		8.0	210	50	110		3-45
-1.3	150/15	8.0	200	45	100		3-258
-1.3	150/15	8.0	200	45	100		3-258
-1.3	150/15	8.0	200	45	100		3-258
-1.3	150/15	8.0	200	45	100		3-258
-0.6-0.9	10/1.0	6.0	300	70	225	6.0	3-269
-0.85	10/1.0	4.5	200	70	260	5.0	3-280

PNP General Purpose Amplifiers (By Ascending B_V) continued

Metal - Glass Packages

Device No.	Pkg.	V_{CEO} V Min.	V_{CBO} V Min.	h_{FE}	mA/V I_C/V_{CE}	$V_{CE(sat)}$ V Max.	mA I_C/I_B
FTSO3906	TO-236	-40	-40	100-300	10/-1.0	-0.25	10/1.0
FTSO4121	TO-236	-40	-40	70-200	10/-1.0	-0.14	10/1.0
FTSO4122	TO-236	-40	-40	150-300	10/-1.0	-0.14	10/1.0
FTSO4248	TO-236	-40	-40	50	0.1/-5.0	-0.25	10/0.5
FTSO4250	TO-236	-40	-40	250-700	0.1/-5.0	-0.25	10/0.5
FTSO4402	TO-236	-40	-40	50-150	150/-2.0	-0.4	150/15
FTSO4403	TO-236	-40	-40	100-300	150/-2.0	-0.4	150/15
FTSOA70	TO-236	-40		40-400	5.0/-10	-0.25	10/1.0
FTSO6518	TO-236	-40	-40	150-300	2.0/-10	-0.5	50/5.0
PN2904	TO-92	-40	-60	40-120	150/-10	-0.4	150/15
PN2905	TO-92	-40	-60	100-300	150/-10	-0.4	150/15
PN2906	TO-92	-40	-60	40-120	150/-10	-0.4	150/15
PN2907	TO-92	-40	-60	100-300	150/-10	-0.4	150/15
PN3251	TO-92	-40	-50	100-300	10/-1.0	-0.25	10/1.0
PN4121	TO-92	-40	-40	70-200	10/-1.0	-0.14	10/1.0
PN4122	TO-92	-40	-40	150-300	10/-1.0	-0.14	10/1.0
PN4248	TO-92	-40	-40	50	0.1/-5.0	-0.25	10/0.5
PN4250	TO-92	-40	-40	250-700	0.1/-5.0	-0.25	10/0.5
2N1132A	TO-39	-40	-60	30-90	150/-10	-1.5	150/15
2N2904	TO-39	-40	-60	40-120	150/-10	-0.4	150/15
2N2905	TO-39	-40	-60	100-300	150/-10	-0.4	150/15
2N2906	TO-18	-40	-60	40-120	150/-10	-0.4	150/15
2N2907	TO-18	-40	-60	100-300	150/-10	-0.4	150/15
2N3905	TO-92	-40	-40	50-150	10/-1.0	-0.25	10/1.0
2N3906	TO-92	-40	-40	100-300	10/-1.0	-0.25	10/1.0
2N4037	TO-39	-40	-60	50-250	150/-10	-1.4	150/15
2N4402	TO-92	-40	-40	50-150	150/-2.0	-0.4	150/15
2N4403	TO-92	-40	-40	100-300	150/-2.0	-0.4	150/15
BCF70	TO-236	-45	-50	215-500	2.0/5.0	-0.3	10/0.50
BCW69	TO-236	-45	-50	120-260	2.0/5.0	-0.3	10/0.5
BCW70	TO-236	-45	-50	215-500	2.0/5.0	-0.3	10/0.5
BCX71H	TO-236	-45	-45	180-310	2.0/5.0	-0.25	10/0.25
BCX71J	TO-236	-45	-45	250-460	2.0/5.0	-0.25	10/0.25

$V_{BE(sat)}$ V Max.	mA I_C/I_B	C_{ob} pF Max.	f_T MHz Min.	t_{on} ns Max.	t_{off} ns Max.	NF dB Max.	Page No.
-0.85	10/1.0	4.5	250	70	300	4.0	3-280
-0.9	10/1.0	4.5	400	40	150		3-156
-0.7-0.9	10/1.0	4.5	450	40	150		3-156
		6.0					3-158
		6.0				2.0	3-158
-0.95	150/15	8.5	150	35	255		3-303
-0.95	150/15	8.5	200	35	255		3-303
		4.0	125				3-118
		4.0					3-103
-1.3	150/15	8.0	200	45	100		3-258
-1.3	150/15	8.0	200	45	100		3-258
-1.3	150/15	8.0	200	45	100		3-258
-1.3	150/15	8.0	200	45	100		3-258
-0.6-0.9	10/1.0	6.0	300	70	225	6.0	3-269
-0.9	10/1.0	4.5	400	40	150		3-156
-0.7-0.9	10/1.0	4.5	450	40	150	6.0	3-156
		6.0					3-158
		6.0				2.0	3-158
-1.3	150/15	30	60	45	35		3-230
-1.3	150/15	8.0	200	45	100		3-258
-1.3	150/15	8.0	200	45	100		3-258
-1.3	150/15	8.0	200	45	100		3-258
-1.3	150/15	8.0	200	45	100		3-258
-0.85	10/1.0	4.5	200	70	260	5.0	3-280
-0.85	10/1.0	4.5	250	70	300	4.0	3-280
		30	60				3-289
-0.95	150/15	8.5	150	35	255		3-303
-0.95	150/15	8.5	200	35	255		3-303
		7.0					3-20
		7.0				10	3-29
		7.0				10	3-29
		6.0		150	800	6.0	3-34
		6.0		150	800	6.0	3-34

PNP General Purpose Amplifiers (By Ascending B_V) continued
Metal - Plastic Packages

Device No.	Pkg.	V_{CEO} V Min.	V_{CBO} V Min.	h_{FE}	mA/V I_C/V_{CE}	$V_{CE(sat)}$ V Max.	mA I_C/I_B
BCX71K	TO-236	-45	-45	380-630	2.0/5.0	-0.25	10/0.25
FTSO3644	TO-236	-45	-45	100-300	150/-10	-0.4	150/15
PN3644	TO-92	-45	-45	100-300	150/-10	-0.4	150/15
FTSO5086	TO-236	-50	-50	250-800	0.1/-5.0	-0.3	10/1.0
FTSO5087	TO-236	-50	-50	250-800	0.1/-5.0	-0.3	10/1.0
2N5086	TO-92	-50	-50	250-800	0.1/5.0	-0.3	10/1.0
2N5087	TO-92	-50	-50	250-800	0.1/-5.0	-0.3	10/1.0
BSR16	TO-236	-60	-60	100-300	150/10	-0.4	150/15
FTSO2904A	TO-236	-60	-60	40-120	150/-10	-0.4	150/15
FTSO2905A	TO-236	-60	-60	100-300	150/-10	-0.4	150/15
FTSO2906A	TO-236	-60	-60	40-120	150/-10	-0.4	150/15
FTSO2907A	TO-236	-60	-60	100-300	150/-10	-0.4	150/15
FTSO3645	TO-236	-60	-60	100-300	150/-10	-0.4	150/15
FTSO3962	TO-236	-60	-60	100-450	1.0/-5.0	-0.25	10/.5
FTSO4249	TO-236	-60	-60	100-300	0.1/-5.0	-0.25	10/0.5
FTSO4354	TO-236	-60	-60	50-500	10/-10	-0.15	150/15
FTSO4355	TO-236	-60	-60	100-400	10/-10	-0.15	150/15
FTSO5855	TO-236	-60	-60	50-300	150/-10	-0.4	150/15
FTSOA55	TO-236	-60	-60	50	100/-1.0	-0.25	100/10
PN2904A	TO-92	-60	-60	40-120	150/-10	-0.4	150/15
PN2905A	TO-92	-60	-60	100-300	150/-10	-0.4	150/15
PN2906A	TO-92	-60	-60	40-120	150/-10	-0.4	150/15
PN2907A	TO-92	-60	-60	100-300	150/-10	-0.4	150/15
PN3645	TO-92	-60	-60	100-300	150/-10	-0.4	150/15
PN4249	TO-92	60	-60	100-300	0.1/-5.0	-0.25	10/0.5
PN4250A	TO-92	-60	-60	250-700	0.1/-5.0	-0.25	10/0.5
PN4354	TO-92	-60	-60	50-500	10/-10	-0.15	150/15
PN4355	TO-92	-60	-60	100-400	10/-10	-0.15	150/15
PN5855	TO-92	-60	-60	50-300	150/-10	-0.4	150/15
2N2904A	TO-39	-60	-60	40-120	150/-10	-0.4	150/15
2N2905A	TO-39	-60	-60	100-300	150/-10	-0.4	150/15
2N2906A	TO-18	-60	-60	40-120	150/-10	-0.4	150/15
2N2907A	TO-18	-60	-60	100-300	150/-10	-0.4	150/15

$V_{BE(sat)}$ V Max.	mA I_C/I_B	C_{ob} pF Max.	f_T MHz Min.	t_{on} ns Max.	t_{off} ns Max.	NF dB Max.	Page No.
		6.0		150	800	6.0	3-34
-1.3	150/15	8.0	200	40	100		3-150
-1.3	150/15	8.0	200	40	100		3-150
		4.0	40			3.0	3-309
		4.0	40			2.0	3-309
		4.0	40			3.0	3-309
		4.0	40			2.0	3-309
1.3	150/15	8.0	200	45	100		3-38
-1.3	150/15	8.0	200	45	100		3-260
-1.3	150/15	8.0	200	45	100		3-260
-1.3	150/15	8.0	200	45	100		3-260
-1.3	150/15	8.0	200	45	100		3-260
-1.3	150/15	8.0	200	40	100		3-150
-0.9	10/0.5	6.0	40			3.0	3-284
		6.0				3.0	3-158
-0.9	150/15	30	100	100	400	3.0	3-165
-0.9	150/15	30	100	100	400	3.0	3-165
-1.3	150/15	15	100				3-190
			100				3-121
-1.3	150/15	8.0	200	45	100		3-260
-1.3	150/15	8.0	200	45	100		3-260
-1.3	150/15	8.0	200	45	100		3-260
-1.3	150/15	8.0	200	45	100		3-260
-1.3	150/15	8.0	200	40	100		3-150
		6.0				3.0	3-158
		6.0				2.0	3-158
-0.9	150/15	30	100	100	400	3.0	3-165
-0.9	150/15	30	100	100	400	3.0	3-165
-1.3	150/15	15	100				3-190
-1.3	150/15	8.0	200	45	100		3-260
-1.3	150/15	8.0	200	45	100		3-260
-1.3	150/15	8.0	200	45	100		3-260
-1.3	150/15	8.0	200	45	100		3-260

PNP General Purpose Amplifiers (By Ascending B_V)
Metal - Plastic Packages

Device No.	Pkg.	V_{CEO} V Min.	V_{CBO} V Min.	h_{FE}	mA/V I_C/V_{CE}	$V_{CE(sat)}$ V Max.	mA I_C/I_B
2N3962	TO-18	-60	-60	100-450	1.0/-5.0	-0.25	10/.5
2N4030	TO-39	-60	-60	40-120	100/-5.0	-0.15	150/15
2N4032	TO-39	-60	-60	100-300	100/-5.0	-0.15	150/15
2N4036	TO-39	-65	-90	20-200	150/-2.0	-0.65	150/15
FTSO4356	TO-236	-80	-80	50-250	10/-10	-0.15	150/15
FTSO5857	TO-236	-80	-80	50-300	150/-10	-0.4	150/15
FTSOA56	TO-236	-80	-80	50	100/-1.0	-0.25	100/10
PN4356	TO-92	-80	-80	50-250	10/-10	-0.15	150/15
2N4031	TO-39	-80	-80	40-120	100/-5.0	-0.15	150/15
2N4033	TO-39	-80	-80	100-300	100/-5.0	-0.15	150/5
BSS63	TO-236	-100	-110	30	10/1.0	-0.25	25/2.5
FTSOL51	TO-236	-100	-100	40-250	50/-5.0	-0.3	50/5.0
FTSO5400	TO-236	-120	-130	40-180	10/-5.0	-0.2	10/1.0
2N5400	TO-92	-120	-130	40-180	10/-5.0	-0.2	10/1.0
FTSO4888	TO-236	-150	-150	40-400	10/-10	-0.5	10/1.0
FTSO4889	TO-236	-150	-150	80-300	10/-10	-0.5	10/1.0
FTSO5401	TO-236	-150	-160	60-240	10/-5.0	-0.2	10/1.0
PN4888	TO-92	-150	-150	40-400	10/-10	-0.5	10/1.0
PN4889	TO-92	-150	-150	80-300	10/-10	-0.5	10/1.0
2N5401	TO-92	-150	-160	60-240	10/-5.0	-0.2	10/1.0
MPSA93	TO-92	-200	-200	30-150	30/-10	-0.4	20/2.0
MPSA92	TO-92	-300	-300	25	30/-10	-0.5	20/2.0

$V_{BE(sat)}$ V Max.	mA I_C/I_B	C_{ob} pF Max.	f_T MHz Min.	t_{on} ns Max.	t_{off} ns Max.	NF dB Max.	Page No.
-0.9	10/0.5	6.0	40			3.0	3-284
-0.9	150/15	20	100	100	400		3-286
-0.9	150/15	20	150	100	400		3-286
-1.4	150/15		60	110	700		3-289
-0.9	150/15	30	100	100	400	3.0	3-165
-1.3	150/15	15	100				3-190
			100				3-121
-0.9	150/15	30	100	100	400	3.0	3-165
-0.9	150/15	20	100	100	400		3-286
-0.9	150/15	20	150	100	400		3-286
-0.9	25/2.5		50				3-42
-1.1	50/2.5	20	100	75	170		3-125
-1.0	10/1.0	60	100			8.0	3-329
-1.0	10/1.0	6.0	100			8.0	3-329
-0.9	10/1.0	4.0	30				3-168
-0.9	10/1.0	4.0	40			3.0	3-168
-1.0	10/1.0	6.0	100			8.0	3-329
-0.9	10/1.0	4.0	30				3-168
-0.9	10/1.0	4.0	40			3.0	3-168
-1.0	10/1.0	6.0	100			8.0	3-329
-0.9	20/2.0		50				3-123
-0.9	20/2.0		50				3-123

Phototransistors (Numeric Listing) cont.
Plastic Package

Device No.	Description	V_{CEO} I_C = 1.0 mA V Min	V_{CEO} Typ	$I_{CE(lt)}$ V_{CE} = 5.0 V mA Min	$I_{CE(lt)}$ Typ	$I_{CE(lt)}$ Max	$V_{CE(sat)}$ H = 20 mW/cm^2 V Min	$V_{CE(sat)}$ Typ	$V_{CE(sat)}$ Max	t_r/t_f µs Typ	Package No.
FPT100	Plastic, Dome Lens General Purpose	30	50	H = 5.0 mW/cm^2 0.2	1.4		I_C = 500 µA	0.16	0.3	2.8	Opto-26
FPT100A	Plastic, Dome Lens 1:3 Sensitivity	30	50	H = 5.0 mW/cm^2 1.0	1.4	3.0	I_C = 500 µA	0.16	0.3	2.8	Opto-26
FPT100B	Plastic, Dome Lens 1:2 Sensitivity	30	50	H = 5.0 mW/cm^2 1.3	1.4	2.6	I_C = 500 µA	0.16	0.3	2.8	Opto-26
FPT110	Plastic, Flat Lens General Purpose	30	50	H = 5.0 mW/cm^2 0.2	0.88		I_C = 500 µA	0.16	0.33	2.8	Opto-28
FPT110A	Plastic, Flat Lens 1:3 Sensitivity	30	50	H = 5.0 mW/cm^2 0.6	0.88	1.8	I_C = 500 µA	0.16	0.33	2.8	Opto-28
FPT110B	Plastic, Flat Lens 1:2 Sensitivity	30	50	H = 5.0 mW/cm^2 0.8	0.88	1.6	I_C = 500 µA	0.16	0.33	2.8	Opto-28
FPT120	Plastic, Dome Lens High Sensitivity	20	50	H = 1.0 mW/cm^2 0.4	1.5		I_C = 1.0 mA	0.25	0.55	18	Opto-26
FPT120A	Plastic, Dome Lens 1:3 Sensitivity	15	30	H = 1.0 mW/cm^2 1.5		4.5	I_C = 1.0 mA	0.25	0.55	18	Opto-26
FPT120B	Plastic, Dome Lens 1:1.5 Sensitivity	15	30	H = 1.0 mW/cm^2 2.0		4.0	I_C = 1.0 mA	0.25	0.55	18	Opto-26
FPT120C	Plastic, Dome Lens High Sensitivity	11	20	H = 5.0 mW/cm^2 16		25	I_C = 1.0 mA	0.35	0.55	18	Opto-26
FPT130	Plastic, Flat Lens High Sensitivity	20	50	H = 1.0 mW/cm^2 0.4	0.9		I_C = 1.0 mA	0.25	0.55	18	Opto-28
FPT130A	Plastic, Flat Lens 1:3 Sensitivity	15	30	H = 1.0 mW/cm^2 0.9		2.7	I_C = 1.0 mA	0.25	0.55	18	Opto-28
FPT130B	Plastic, Flat Lens 1:2 Sensitivity	15	30	H = 1.0 mW/cm^2 1.2		2.4	I_C = 1.0 mA	0.25	0.55	18	Opto-28
FPT320	Plastic, Dome Lens 1:3 Sensitivity	20	50	H = 1.0 mW/cm^2 0.75	1.5	2.25	I_C = 1.0 mA	0.25	0.55	18	Opto-26

Note Data Sheets:
FPT100, FPT100A, FPT100B, FPT110, FPT110A, FPT110B - page 3-77.
FPT120, FPT120A, FPT120B, FPT120C, FPT130, FPT130A, FPT130B - page 3-79.
FPT320 - page 3-81.

NPN Power Transistors (By Descending B_V)
Metal Package

Device No.	V_{CEO} V Min.	I_C A Max.	h_{FE} Min.	h_{FE} Max.	I_C mA	V_{CE} V	$V_{CE(sat)}$ V	I_C /	I_B	P_D 25° C W	f_T MHz Min.	Pkg. No.	Page No.
2N3439	350	1.0	40	160	20	10	0.5	50	4.0	10	5.0	TO-39	3-273
2N3440	250	1.0	40	160	20	10	0.5	50	4.0	10	5.0	TO-39	3-273
2N5682	120	1.0	40	150	250	2.0	1.0	500	50	10		TO-39	3-335
2N5681	100	1.0	40	150	250	2.0	1.0	500	50	10		TO-39	3-335
2N5320	100	2.0	30	130	500	4.0	0.5	500	50	10	10	TO-39	3-325
2N5338	100	5.0	30	120	2000	2.0	1.2	5000	500	6.0		TO-39	3-327
2N5336	80	5.0	30	120	2000	2.0	1.2	5000	500	6.0		TO-39	3-327
2N4239	80	1.0	15		1000	1.0	0.6	1000	100	5.0	1.0	TO-39	3-299
2N5321	75	2.0	40	250	500	4.0	0.8	500	50	10	10	TO-39	3-325
2N4238	60	1.0	30		500	4.0	0.6	1000	100	5.0	1.0	TO-39	3-299
2N4896	60	5.0	100	300	2000	2.0	1.0	5000	500	4.0	20	TO-39	3-307
2N4237	40	1.0	30	150	250	1.0	0.6	1000	100	5.0	1.0	TO-39	3-299

PNP Power Transistors (By Descending B_V)
Metal Package

Device No.	V_{CEO} V Min.	I_C A Max.	h_{FE} Min.	h_{FE} Max.	I_C mA	V_{CE} V	$V_{CE(sat)}$ V	I_C /	I_B	P_D 25° C W	f_T MHz Min.	Pkg. No.	Page No.
2N5416	-300	1.0	30	120	50	-10	-2.0	50	5.0	10		TO-39	3-331
2N5415	-200	1.0	30	150	50	-10	-2.5	50	5.0	10		TO-39	3-331
2N5680	-120	1.0	40	150	250	-2.0	-2.0	1000	200	10		TO-39	3-335
2N5679	-100	1.0	40	150	250	-2.0	-2.0	1000	200	10		TO-39	3-335
2N4236	-80	1.0	30	150	250	-1.0	-0.6	1000	125	6.0		TO-5	3-297
2N5322	-75	1.0	30	130	500	-4.0	-0.7	500	50	10		TO-39	3-325
2N4235	-60	1.0	30	150	250	-1.0	-0.6	1000	125	6.0		TO-5	3-297
2N5323	-50	1.0	40	250	500	-4.0	-1.2	500	50	10		TO-39	3-325
2N4234	-40	1.0	30	150	250	-1.0	-0.6	1000	125	6.0		TO-5	3-297

NOTES

FAIRCHILD

A Schlumberger Company

BA128/BA130

General Purpose Diodes

- **WIV . . . 50 V (BA128), 25 V (BA130)**
- **I_R . . . 100 nA (MAX) @ WIV**

PACKAGES

BA128	DO-35
BA130	DO-35

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature Range	−65°C to +200°C
Maximum Junction Operating Temperature	175°C
Lead Temperature (10 seconds)	260°C

Power Dissipation (Note 2)

Maximum Total Power Dissipation at 25°C Ambient	500 mW
Linear Power Derating Factor (from 25°C)	3.33 mW/°C

Maximum Voltage and Currents

WIV	Working Inverse Voltage	BA128	50 V
		BA130	25 V
I_O	Average Rectified Current		200 mA
I_F	Continuous Forward Current		500 mA
i_f	Peak Repetitive Forward Current		600 mA
$i_{f\ (surge)}$	Peak Forward Surge Current		
	Pulse Width = 1 s		1.0 A
	Pulse Width = 1 μs		4.0 A

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	BA128		BA130		UNITS	TEST CONDITIONS
		MIN	MAX	MIN	MAX		
V_F	Forward Voltage	0.73	1.00			V	I_F = 50 mA
		0.63	0.79	0.69	1.00	V	I_F = 10 mA
		0.51	0.64	0.56	0.71	V	I_F = 1.0 mA
		0.40	0.52	0.45	0.58	V	I_F = 0.1 mA
				0.34	0.47	V	I_F = 0.01 mA
I_R	Reverse Current		100			nA	V_R = 50 V
					100	nA	V_R = 25 V
			100			μA	V_R = 50 V, T_A = 100°C
					100	μA	V_R = 25 V, T_A = 100°C
BV	Breakdown Voltage	75				V	I_R = 100 μA
				30		V	I_R = 5 μA
C	Capacitance		5.0		2.0	pf	V_R = 0, f = 1.0 MHz

NOTES:
1. These ratings are limiting values above which the serviceability of the diode may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty-cycle operation.
3. For product family characteristic curves, refer to Chapter 4, D4.

FAIRCHILD

A Schlumberger Company

BA217/BA218

General Purpose Diodes

- **WIV . . . 10 V to 100 V**
- **t_{rr} . . . 4ns (MAX) BA216–218**

PACKAGES

BA217	DO-35
BA218	DO-35

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature Range	−65°C to +200°C
Maximum Junction Operating Temperature	+175°C
Lead Temperature	+260°C

Power Dissipation (Note 2)

Maximum Total Power Dissipation at 25°C Ambient	500 mW
Linear Power Derating Factor (from 25°C)	3.33 mW/°C

Maximum Voltage and Currents

WIV	Working Inverse Voltage	BA218	50 V	BA217	30 V
I_F	Continuous Forward Current				100 mA
I_f	Peak Repetitive Forward Current				300 mA
$i_{f(surge)}$	Peak Forward Surge Current				400 mA
	Pulse Width = 1 s				1.0 A
	Pulse Width = 1 μs				4.0 A

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	BA217·BA218		UNITS	TEST CONDITIONS
		MIN	MAX		
V_F	Forward Voltage				I_F = 100 mA
			1.50		I_F = 50 mA
					I_F = 15 mA
			1.00		I_F = 10 mA
					I_F = 3.0 mA
			0.70		I_F = 1.0 mA
					I_F = 0.2 mA
I_R	Reverse Current			nA	V_R = 10 V
	BA217		50	nA	V_R = 10 V
	BA218		50	nA	V_R = 25 V
	BA217		200	nA	V_R = 30 V
	BA218		200	nA	V_R = 50 V
				nA	V_R = 50 V
				nA	V_R = 100 V
C	Capacitance		3.0	pF	V_R = 0, f = 1 MHz
t_{rr}	Reverse Recovery Time		4.0	ns	I_F = 10 mA, I_R = 60 mA, R_L = 100 Ω (Note 3)
				ns	I_F = 30 mA, I_R = 30 mA, R_L = 100 Ω (Note 4)

NOTES:
1. These ratings are limiting values above which the serviceability of the diode may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty-cycle operation.
3. Recovery to I_R = 1 mA.
4. Recovery to I_R = 3 mA.
5. For product family characteristic curves, refer to Chapter 4, D4

FAIRCHILD
A Schlumberger Company

BAS16
Switching Diode

- P_D ... **350 mW @ T_A = 25° C**

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

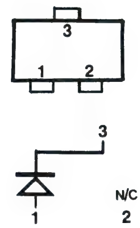
Power Dissipation (Note 2)

Total Dissipation at 25° C Ambient Temperature	0.350 W*

Voltages & Currents

V_R	Continuous Reverse Voltage	75 V
I_F	Peak Forward Current	200 mA
I_{FM}	Peak Forward Surge Current	500 mA

Connection Diagram



PACKAGE

BAS16	TO-236AA/AB

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 4)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
I_R	Reverse Voltage Leakage Current		1.0 50 30	μA μA μA	V_R = 75 V V_R = 75 V, T_J = 150° C V_R = 25 V, T_J = 150° C
$V_{(BR)}$	Reverse Breakdown Voltage	75		V	I_{BR} = 100 μA
V_F	Forward Voltage		715 855 1100 1300	mV mV mV mV	I_F = 1.0 mA I_F = 10 mA I_F = 50 mA I_F = 100 mA
C_D	Diode Capacitance		2.0	pF	V_R = 0, f = 1.0 MHz
V_{FR}	Forward Recovery Voltage		1.75	V	I_F = 10 mA, t_r = 20 ns
t_{rr}	Reverse Recovery Time		6.0	ns	I_F = I_R = 10 mA, R_L = 100 Ω
Q_S	Stored Charge		45	pC	I_F = 10 mA to V_R = 5.0 V, R_L = 500 Ω

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. For product family characteristic curves, refer to Curve Set D-4.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

FAIRCHILD

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BAV17/BAV18/BAV19 BAV20/BAV21

General Purpose Diodes

- **V_F . . . 1.0 V (Max) @ 100 mA**
- **I_R . . . 100 nA @ WIV**

PACKAGES

BAV17	DO-35
BAV18	DO-35
BAV19	DO-35
BAV20	DO-35
BAV21	DO-35

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature Range	−65°C to +200°C
Maximum Junction Operating Temperature	+175°C
Lead Temperature	+260°C

Power Dissipation (Note 2)

Maximum Total Power Dissipation at 25°C Ambient	500 mW
Linear Power Derating Factor (from 25°C)	3.33 mW/°C

Maximum Voltage and Currents

WIV	Working Inverse Voltage		
		BAV 17	20 V
		BAV 18	50 V
		BAV 19	100 V
		BAV 20	150 V
		BAV 21	200 V
I_O	Average Rectified Current		100 mA
I_F	Continuous Forward Current		300 mA
i_f	Peak Repetitive Forward Current		400 mA
$i_{f(surge)}$	Peak Forward Surge Current		
	Pulse Width=1 μsec.		4 A
	Pulse Width=1 sec.		1 A

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC		MIN	TYP	MAX	UNITS	TEST CONDITIONS
V_F	Forward Voltage				1.00	V	I_F=100 mA
					1.25	V	I_F=200 mA
I_R	Reverse Current	BAV 21			100	nA	V_R=200 V
					15	μA	V_R=200 V, T_A=100°C
		BAV 20			100	nA	V_R=150 V
					15	μA	V_R=150 V, T_A=100°C
		BAV 19			100	nA	V_R=100 V
					15	μA	V_R=100 V, T_A=100°C
		BAV 18			100	nA	V_R=50 V
					15	μA	V_R=50 V, T_A=100°C
		BAV 17			100	nA	V_R=20 V
					15	μA	V_R=20 V, T_A=100°C
BV	Breakdown Voltage	BAV 21	250			V	I_R=100 μA
		BAV 20	200			V	I_R=100 μA
		BAV 19	120			V	I_R=100 μA
		BAV 18	60			V	I_R=100 μA
		BAV 17	25			V	I_R=100 μA
C	Capacitance			1.5	5.0	pF	V_R=0,f=1 MHz
t_{rr}	Reverse Recovery Time (Note 3)				50	ns	I_f=30mA,I_r=30mA, R_L=100Ω
diff	Differential Resistance			5.0		Ω	I_F=10mA

NOTES:
1. These ratings are limiting values above which the serviceability of the diode may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty-cycle operation.
3. Recovery to I_R=3 mA.
4. For product family characteristic curves, refer to Chapter 4 BAV 17/18 D4, BAV 19/20/21 D1.

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BAV70
Switching Diode

- P_D ... **350 mW @ T_A = 25° C**

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

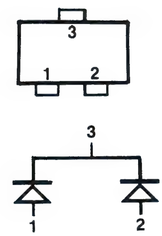
Power Dissipation (Note 2)

Total Dissipation at 25° C Ambient Temperature	0.350 W*

Voltages & Currents

V_R	Continuous Reverse Voltage	70 V
I_F	Peak Forward Current	200 mA
I_{FM}	Peak Forward Surge Current	500 mA

Connection Diagram



PACKAGE

BAV70	TO-236AA/AB

3

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 4)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
I_R	Reverse Voltage Leakage Current		60 5.0 100	μA μA μA	$V_R = 25$ V, $T_J = 150°$C $V_R = 70$ V, $V_R = 70$ V, $T_J = 150°$ C
$V_{(BR)}$	Reverse Breakdown Voltage	70		V	$I_{(BR)} = 100$ μA
V_F	Forward Voltage		715 855 1100 1300	mV mV mV mV	$I_F = 1.0$ mA $I_F = 10$ mA $I_F = 50$ mA $I_F = 100$ mA
C_T	Diode Capacitance		1.5	pF	$V_R = 0$, f = 1.0 MHz
t_{rr}	Reverse Recovery Time		6.0	ns	$I_F = I_R = 10$ mA, $V_R = 5.0$ V $I_{R(REC)} = 1.0$ mA

NOTES:
1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. For product family characteristic curves, refer to Curve Set D-4.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

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BAV74
Switching Diode

- P_D ... 350 mW @ T_A = 25° C

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

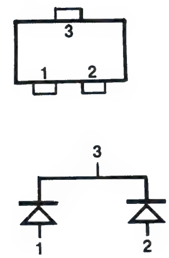
Power Dissipation (Note 2)

Total Dissipation at 25° C Ambient Temperature	0.350 W*

Voltages & Currents

V_R	Continuous Reverse Voltage	50 V
I_F	Peak Forward Current	200 mA
I_{FM}	Peak Forward Surge Current	500 mA

Connection Diagram



PACKAGE

BAV74	TO-236AA/AB

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 4)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
I_R	Reverse Voltage Leakage Current		100 0.1	μA μA	V_R = 50 V, T_J = 150° C V_R = 50 V
$V_{(BR)}$	Reverse Breakdown Voltage	50		V	I_{BR} = 5.0 μA
V_F	Forward Voltage		1.0	V	I_F = 100 mA
C_T	Diode Capacitance		2.0	pF	V_R = 0, f = 1.0 MHz
t_{rr}	Reverse Recovery Time		4.0	ns	$I_F = I_R$ = 10 mA, R_L = 100 Ω $I_{R(REC)}$ = 1.0 mA, measured at I_R = 1.0 mA

NOTES:
1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. For product family characteristic curves, refer to Curve Set D-4.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

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BAV99

Dual Series Switching Diode

- **P_D . . . 350 mW @ T_A = 25°C**

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

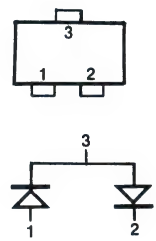
Power Dissipation (Note 2)

Total Dissipation at 25° C Ambient Temperature	0.350 W*

Voltages & Current

V_R	Continuous Reverse Voltage	70 V
I_F	Peak Forward Current	100 mA
I_{FM}	Peak Forward Surge Current	500 mA

Connection Diagram



PACKAGE

BAV99	TO-236AA/AB

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 4)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
I_R	Reverse Voltage Leakage Current		30 2.5 50	μA μA μA	V_R = 25 V, T_J = 150°C V_R = 70 V V_R = 70 V, T_J = 150°C
$V_{(BR)}$	Reverse Breakdown Voltage	70		V	I_{BR} = 100 μA
V_F	Forward Voltage		715 855 1100 1300	mV mV mV mV	I_F = 1.0 mA I_F = 10 mA I_F = 50 mA I_F = 100 mA
C_T	Diode Capacitance		1.5	pF	V_R = 0, f = 1.0 MHz
t_{rr}	Reverse Recovery Time		6.0	ns	$I_F = I_R$ = 10 mA, $I_{R(REC)}$ = 1.0 mA

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. For product family characteristic curves, refer to Curve Set D-4.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

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BAW56

Dual Switching Diode

- P_D ... 350 mW @ T_A = 25°C

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° to 150°C
Operating Junction Temperature	150°C

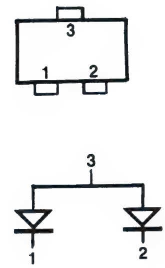
Power Dissipation (Note 2)

Total Dissipation at 25°C Ambient Temperature	0.350 W*

Voltages & Current

V_R	Continuous Reverse Voltage	70 V
I_F	Peak Forward Current	200 mA
I_{FM}	Peak Forward Surge Current	200 mA

Connection Diagram



PACKAGE

BAW56 TO-236AA/AB

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted) (Note 4)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
I_R	Reverse Voltage Leakage Current		30 2.5 50	μA μA μA	V_R = 25 V, T_J = 150°C V_R = 70 V V_R = 70 V, T_J = 150°C
$V_{(BR)}$	Reverse Breakdown Voltage	70		V	I_{BR} = 100 μA
V_F	Forward Voltage		715 855 1100 1300	mV mV mV mV	I_F = 1.0 mA I_F = 10 mA I_F = 50 mA I_F = 100 mA
C_T	Diode Capacitance		2.5	pF	V_R = 0, f = 1.0 MHz
t_{rr}	Reverse Recovery Time		6.0	ns	$I_F = I_R$ = 10 mA, $I_{R(REC)}$ = 1.0 mA

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150°C and junction-to-ambient thermal resistance of 357°C/W (derating factor of 2.8 mW/°C).
4. For product family characteristic curves, refer to Curve Set D-4.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

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BAW75/BAW76

High Speed Computer Diodes

- t_{rr} . . . 4 ns (max)
- C . . . 4 pf (max)

PACKAGES

BAW75	DO-35
BAW76	DO-35

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature Range	−65°C to +200°C
Maximum Junction Operating Temperature	+175°C
Lead Temperature	+260°C

Power Dissipation (Note 2)

Maximum Total Power Dissipation at 25°C Ambient	500 mW
Linear Power Derating Factor (from 25°C)	3.33 mW/°C

Maximum Voltage and Currents

WIV	Working Inverse Voltage	BAW 75	25V
		BAW 76	50V
I_O	Average Rectified Current		100 mA
I_F	Continuous Forward Current		300 mA
i_f	Peak Repetitive Forward Current		400 mA
i_f (surge)	Peak Forward Surge Current		
	Pulse Width = 1 s		1.0 A
	Pulse Width = 1 μs		4.0 A

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	BAW 75		BAW 76		UNITS	TEST CONDITIONS
		MIN	MAX	MIN	MAX		
V_F	Forward Voltage		1.0			V	I_F = 30 mA
					1.0	V	I_F = 100 mA
I_R	Reverse Current		100			nA	V_R = 25 V
					100	nA	V_R = 50 V
			100			μA	V_R = 25 V, T_A = 150°C
					100	μA	V_R = 50 V, T_A = 150°C
B_V	Breakdown Voltage	35		75		V	I_R = 5.0 μA
C	Capacitance		4.0		2.0	pf	V_R = 0, f = 1 MHz
t_{rr}	Reverse Recovery Time		4.0		4.0	ns	$I_f = I_r$ = 10 mA Recovery to 1 mA
			2.0		2.0	ns	I_f = 10 mA, V_R = 6 V, R_L = 100 Ω

NOTES:
1. These ratings are limiting values above which the serviceability of the diode may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty-cycle operation.
3. For product family characteristic curves, refer to Chapter 4, D4.

3

FAIRCHILD

A Schlumberger Company

BAX13

High Speed Switching Diode

- **C . . . 3.0 pF (MAX)**
- **t_{rr} . . . 4.0 ns (MAX)**

PACKAGE

BAX13 DO-35

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures		
Storage Temperature Range		−65°C to +200°C
Maximum Operating Junction Temperature		+175°C
Lead Temperature		+260°C
Power Dissipation (Note 2)		
Maximum Total Dissipation at 25°C Ambient		500 mW
Linear Derating Factor (from 25°C)		3.33 mW / °C
Maximum Voltages and Currents		
V_{RRM}	Repetitive Peak Reverse Voltage	50 V
V_R	Reverse Voltage	50 V
I_O	Average Rectified Current	100 mA
I_F	Forward Current	300 mA
i_f	Recurrent Peak Forward Current	400 mA
I_{FSM}	Peak Forward Surge Current	
	Pulse Width = 1.0 s	1.0 A
	Pulse Width = 1.0 μs	4.0 A

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
V_F	Forward Voltage		0.7	V	I_F = 2.0 mA
			0.8	V	I_F = 10 mA, T_A = 100°C
			1.0	V	I_F = 20 mA.
			1.53	V	I_F = 75 mA.
I_R	Reverse Current		25	nA	V_R = 10 V
			10	μA	V_R = 10 V, T_A = 150°C
			50	nA	V_R = 25 V
			200	nA	V_R = 50 V
			25	μA	V_R = 50 V, T_A = 150°C
C	Capacitance		3.0	pF	V_R = 0, f = 1.0 MHz
t_{rr}	Reverse Recovery Time		4.0	ns	I_f = 10 mA, V_r = 6.0 V, R_L = 100Ω, I_r = 1.0 mA
Q_S	Recovered Charge		45	pC	I_f = 10 mA, V_r = 5.0 V, R_L = 500Ω

NOTES:
1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. For product family characteristic curves, refer to Chapter 4, D4.

FAIRCHILD

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BAX16

General Purpose Industrial Diode

- **BV . . . 180 V (MIN) @ 100 μA**
- **I_R . . . 100 nA (MAX) @ 150V**

PACKAGE

BAX16 DO-35

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature Range	−65°C to +200°C
Maximum Junction Operating Temperature	+175°C
Lead Temperature	+260°C

Power Dissipation (Note 2)

Maximum Total Power Dissipation at 25°C Ambient	500 mW
Linear Power Derating Factor (from 25°C)	3.33 mW/°C

Maximum Voltage and Currents

WIV	Working Inverse Voltage	150 V
I_O	Average Rectified Current	200 mA
I_F	Continuous Forward Current	500 mA
i_f	Peak Repetitive Forward Current	600 mA
$i_{f(surge)}$	Peak Forward Surge Current	
	Pulse Width = 1 s	1.0 A
	Pulse Width = 1 μs	4.0 A

3

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
V_F	Forward Voltage		1.5	V	I_F = 200 mA
			1.4	V	I_F = 200 mA, T_A = 175°C
			1.3	V	I_F = 100 mA
			0.85	V	I_F = 10 mA, T_A = 100°C
			0.65	V	I_F = 1 mA
I_R	Reverse Current		100	nA	V_R = 150 V
			100	μA	V_R = 150 V, T_A = 150°C
			25	nA	V_R = 50 V
			25	μA	V_R = 50 V, T_A = 150°C
BV	Breakdown Voltage	180		V	I_R = 100 μA
C	Capacitance		10	pf	V_R = 0, f = 1 MHz
t_{rr}	Reverse Recovery Time (Note 3)		120	ns	I_F = 30 mA, I_R = 30 mA R_L = 100 Ω
Qs	Stored Charge		700	pC	I_F = 10 mA, V_R = 5 V R_L = 500 Ω

NOTES:
1. These ratings are limiting values above which the serviceability of the diode may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty-cycle operation.
3. Recovery to I_R = 3 mA.
4. For product family characteristic curves, refer to Chapter 4, D1.

FAIRCHILD

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BAY71

Fast Switching Diode

- t_{rr}...4.0 ns (MAX)
- C...2.0 pF (MAX)

PACKAGE

BAY71 DO-35

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures	
Storage Temperature Range	−65°C to +200°C
Max Junction Operating Temperature	+175°C
Lead Temperature	+260°C
Power Dissipation (Note 2)	
Maximum Total Dissipation at 25°C Ambient	500 mW
Linear Derating Factor (from 25°C)	3.33 mW / °C

Maximum Voltage and Currents

WIV	Working Inverse Voltage	35 V
I_O	Average Rectified Current	100 mA
I_F	Forward Current Steady State DC	300 mA
i_f	Recurrent Peak Forward Current	400 mA
$i_{f(surge)}$	Peak Forward Surge Current	
	Pulse Width = 1.0 s	1.0 A
	Pulse Width = 1.0 μs	4.0 A

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
V_F	Forward Voltage	0.76	1.00	V	I_F = 20 mA
		0.69	0.88	V	I_F = 10 mA
		0.57	0.69	V	I_F = 1.0 mA
		0.46	0.56	V	I_F = 0.1 mA
I_R	Reverse Current		100	nA	V_R = 35 V
			100	μA	V_R = 35 V, T_A = 125°C
BV	Breakdown Voltage	50		V	I_R = 5.0 μA
t_{rr}	Reverse Recovery Time (Note 5)		2.0	ns	I_F = 10 mA, I_R = 6.0 mA, R_L = 100 Ω, V_R = 6.0 V
V_{fr}	Forward Recovery Peak Voltage (Note 3)		3.0	V	I_F = 100 mA (pulsed)
t_{fr}	Forward Recovery Time (Note 3)		40	ns	I_F = 100 mA (pulsed)
Q_S	Stored Charge (Note 4)		65	pC	I_F = 20 mA, I_R = 2.0 mA
			50	pC	I_F = 10 mA, I_R = 1.0 mA
RE	Rectification Efficiency (Note 6)	45		%	f = 100 MHz
C	Capacitance		2.0	pF	V_R = 0, f = 1.0 MHz

NOTES:
1. The maximum ratings are limiting values above which life or satisfactory performance may be impaired.
2. These are steady state limits.The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. The oscilloscope used as the response detector shall have a bandwidth of at least 10 MHz (3 dB down), and shall be calibrated using a deposited carbon resistor of 50 Ω in the diode test clips. t_{fr} is defined as the difference between the 10% point of the pulse and the point where V_F is to within 10% of the quiescent value.
4. Measured on the Tektronix "S" unit.
5. Recovery to 1.0 mA.
6. Rectification efficiency is defined as the ratio of dc load voltage to peak rf input voltage to the detector circuit, measured with 2.0 V rms input to the circuit. Load resistance 5.0 kΩ, load capacitance 20 pF.
7. For product family curves, refer to Chapter 4, D4.

FAIRCHILD
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BAY72/BAY80

General Purpose High Conductance Diodes

- V_F . . . 1.0V (MAX) @ 100 mA (BAY72)
- V_F . . . 1.0V (MAX) @ 150 mA (BAY80)

PACKAGES

BAY72	DO-35
BAY80	DO-35

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature Range	−65°C to +200°C
Maximum Junction Operating Temperature	+175°C
Lead Temperature	+260°C

Power Dissipation (Note 2)

Maximum Total Power Dissipation at 25°C Ambient	500 mW
Linear Power Derating Factor (from 25°C)	3.33 mW/°C

Maximum Voltage and Currents

WIV	Working Inverse Voltage	BAY 72	100 V
		BAY 80	120 V
I_O	Average Rectified Current		200 mA
I_F	Continuous Forward Current		500 mA
i_f	Peak Repetitive Forward Current		600 mA
$i_{f(surge)}$	Peak Forward Surge Current		
	Pulse Width = 1 s		1.0 A
	Pulse Width = 1 μs		4.0 A

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	BAY 72		BAY 80		UNITS	TEST CONDITIONS
		MIN	MAX	MIN	MAX		
V_F	Forward Voltage				1.00	V	I_F = 150 mA
		0.78	1.00			V	I_F = 100 mA
		0.73	0.92			V	I_F = 50 mA
		0.63	0.78			V	I_F = 10 mA
		0.51	0.64			V	I_F = 1.0 mA
I_R	Reverse Current				100	nA	V_R = 120 V
					150	μA	V_R = 120 V, T_A = 100°C
			100			nA	V_R = 100 V
			100			μA	V_R = 100 V, T_A = 125°C
BV	Breakdown Voltage	125		150		V	I_R = 100 μA
C	Capacitance		5.0		6.0	pF	V_R = 0, f = 1 MHz
t_{rr}	Rev. Rec. Time (note 3)		50		60	ns	$I_f = I_r$ = 30 mA, R_L = 75 Ω
	(note 4)		400			ns	I_f = 30 mA, V_R = 35 V
V_{fr}	Fwd. Rec. Voltage (note 5)		2.5			v	R_L = 2.0 KΩ, C_L = 10 pF
V_{fr}	Fwd. Rec. Voltage (note 5)		2.5			V	I_f = 100 mA (pulsed)
t_{fr}	Fwd. Rec. Time (note 5)		50			ns	I_f = 100 mA (pulsed)
Q_s	Stored Change (note 6)		250			pC	I_f = 20 mA, I_r = 1.0 mA
R_E	Rect. Efficiency (note 7)	35				%	f = 100 MHz

NOTES:
1. These ratings are limiting values above which the serviceability of the diode may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty-cycle operation.
3. Recovery to 1.0 mA.
4. Recovery to 400 kΩ, Jan 256 Circuit.
5. The oscilloscope used as the response detector shall have a bandwidth of at least 10 MHz (3 dB down), and shall be calibrated using a deposited carbon resistor of 50 Ω in the diode test clips. t_{fr} is defined as the difference between the 10% point of the pulse and the point where V_F is to be within 10% of the quiescent value. Pulse conditions shall be 0.1 μs wide at base, 20 ns maximum rise time, repetition rate = 100 kHz max.
6. Measured on the Tektronix "S" unit.
7. Rectification efficiency is defined as the ratio of dc load voltage to peak rf input to the circuit. Load resistance of 5.0 kΩ, load capacitance 20 pF.
8. For product family characteristic curves, refer to Chapter 4, D1.

FAIRCHILD

A Schlumberger Company

BAY73/BA129

High Voltage Low Leakage Diodes

- **BV... 125 V (MIN) @ 100 μA (BAY73)**
- **BV... 200 V (MIN) @ 100 μA (BA129)**

PACKAGES

BAY73	DO-35
BA129	DO-35

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature Range	−65°C to +200°C
Maximum Junction Operating Temperature	+175°C
Lead Temperature	+260°C

Power Dissipation (Note 2)

Maximum Total Power Dissipation at 25°C Ambient	500 mW
Linear Power Derating Factor (from 25°C)	3.33 mW / °C

Maximum Voltage and Currents

WIV	Working Inverse Voltage	BAY73	100 V
		BA129	180 V
I_O	Average Rectified Current		200 mA
I_F	Continuous Forward Current		500 mA
i_f	Peak Repetitive Forward Current		600 mA
$i_{f(surge)}$	Peak Forward Surge Current		
	Pulse Width = 1 s		1.0 A
	Pulse Width = 1 μs		4.0 A

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	BAY73		BA129		UNITS	TEST CONDITIONS
		MIN	MAX	MIN	MAX		
V_F	Forward Voltage	0.85	1.00			V	I_F = 200 mA
		0.81	0.94			V	I_F = 100 mA
		0.78	0.88	0.78	1.00	V	I_F =50 mA
		0.69	0.80	0.69	0.83	V	I_F = 10 mA
		0.67	0.75			V	I_F = 5.0 mA
		0.60	0.68	0.60	0.71	V	I_F = 1.0 mA
				0.51	0.60	V	I_F = 0.1 mA
I_R	Reverse Current		500			nA	V_R = 20 V, T_A = 125°C
			5.0			nA	V_R = 100 V
			1.0			μA	V_R = 100 V, T_A = 125°C
					10	nA	V_R = 180 V
					5.0	μA	V_R = 180 V, T_A = 100°C
BV	Breakdown Voltage	125		200		V	I_R = 100 μA
C	Capacitance		8.0		6.0	pf	V_R = 0, f = 1.0 MHz
t_{rr}	Reverse Recovery Time		3.0			μs	I_f = 10 mA, V_r = 35 V R_L = 1.0 to 100 KΩ C_L = 10 pf, JAN 256

NOTES:
1. These ratings are limiting values above which the serviceability of the diode may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulses or low duty-cycle operation.
3. For product family characteristic curves, refer to Chapter 4, D2

FAIRCHILD

A Schlumberger Company

BAY74

High Conductance Ultra Fast Diode

- t_{rr} . . . **4.0 ns (MAX)**
- **C . . . 3.0 pF (MAX)**

PACKAGE

BAY74	DO-35

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature Range	−65° C to +200° C
Maximum Operating Junction Temperature	+175° C
Lead Temperature	+260° C

Power Dissipation (Note 2)

Maximum Total Dissipation at 25° C Ambient	500 mW
Linear Deviation Factor (from 25° C)	3.33 mW

Maximum Voltage and Currents

WIV	Working Inverse Voltage	35 V
I_O	Average Rectified Current	100 mA
I_F	Continuous Forward Current	300 mA
i_f	Recurrent Peak Forward Current	400 mA
i_f (surge)	Peak Forward Surge Current	
	Pulse Width = 1.0 s	1.0 A
	Pulse Width = 1.0 μs	4.0 A

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
V_F	Forward Voltage	0.85	1.10	V	I_F = 300 mA
		0.82	1.00	V	I_F = 200 mA
		0.78	0.93	V	I_F = 100 mA
		0.73	0.88	V	I_F = 50 mA
		0.65	0.77	V	I_F = 10 mA
		0.54	0.65	V	I_F = 1 0 mA
I_R	Reverse Current		100	nA	V_R = 35 V
			100	μA	V_R = 35 V, T_A = 125° C
BV	Breakdown Voltage	50		V	I_R = 5.0 μA
C	Capacitance		3.0	pF	V_R = 0, f = 1.0 MHz
t_{rr}	Reverse Recovery Time (Note 4)		4.0	ns	$I_f = I_r$ = 10 mA to 200 mA
			6.0	ns	$I_f = I_r$ = 200 mA to 400 mA
t_{rr}	Reverse Recovery Time (Note 3)		6.0	ns	I_f = 10 mA, I_r = 1.0 mA

NOTES:
1. The maximum ratings are limiting values above which life or satisfactory performance may be impaired.
2. These are steady-state limits. The factory should be consulted on applications involving pulses or low duty-cycle operations.
3. Recovery to 0.1 mA.
4. Recovery to 10% of I_f.
5. For product family characteristic curves, refer to Chapter 4, D4.

FAIRCHILD
A Schlumberger Company

BAY82/1N4244 1N4376

Ultra Fast Switching Diodes

- t_{rr}...750 ps (MAX)
- C...0.8 pF (MAX) 1N4244

PACKAGES

BAY82	DO-7
1N4244	DO-7
1N4376	DO-7

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature Range	−65°C to +200°C
Maximum Junction Operating Temperature	+175°C
Lead Temperature	+260°C

Power Dissipation (Note 2)

Maximum Total Power Dissipation at 25°C Ambient	250 mW
Linear Power Derating Factor (from 25°C)	1.67 mW/°C

Maximum Voltage and Currents

WIV	Working Inverse Voltage	10 V (12 V BAY82)
I_O	Average Rectified Current	50 mA
I_F	Continuous Forward Current	150 mA
i_f	Peak Repetitive Forward Current	150 mA
$i_{f(surge)}$	Peak Forward Surge Current Pulse Width = 1 s	250 mA

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	BAY82		1N4244		1N4376		UNITS	TEST CONDITIONS
		MIN	MAX	MIN	MAX	MIN	MAX		
V_F	Forward Voltage	0.90	1.35			0.89	1.10	V	I_F = 50 mA
		0.80	1.00		1.00	0.81	0.95	V	I_F = 20 mA
		0.77	0.94			0.76	0.88	V	I_F = 10 mA
		0.64	0.79			0.64	0.74	V	I_F = 1.0 mA
		0.53	0.66			0.52	0.61	V	I_F = 0.1 mA
		0.41	0.53			0.42	0.50	V	I_F = 10 μA
I_R	Reverse Current				100		100	nA	V_R = 10 V
					100		100	μA	V_R = 10 V, T_A = 150°C
			100					nA	V_R = 12 V
			50					μA	V_R = 12 V, T_A = 100°C
					250			nA	V_R = 15 V
BV	Breakdown Voltage	15		20		20		V	I_R = 5.0 μA
C	Capacitance		1.3		0.8		1.0	pF	V_R = 0, f = 1 MHz
t_{rr}	Reverse Recovery Time (Note 3)		750		750		750	ps	$I_f = I_r$ = 10 mA R_L = 100 Ω

NOTES:
1. These ratings are limiting values above which the serviceability of the diode may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty-cycle operation.
3. Recovery to I_r = 1.0 mA.
4. For product family characteristic curves, refer to Chapter 4, D3.

BCF29/BCF30

PNP Low Noise Transistor

- h_{FE} ... **BCF29 120-260, BCF30 215-500**
- V_{CEO} ... **-32 V (Max)**
- **NF ... 4.0 dB (Max)**

PACKAGE

BCF29	TO-236AA/AB
BCF30	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at 25° C Ambient Temperature	0.350 W*

Voltages & Currents (Note 4)

V_{CEO}	Collector to Emitter Voltage	−32 V
V_{CBO}	Collector to Base Voltage	−32 V
V_{CES}	Collector to Emitter Voltage	−32 V
V_{EBO}	Emitter to Base Voltage	−5.0 V
I_C	Collector Current	100 mA
I_{CM}	Collector Current	200 mA

3

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	BCF29 MIN	BCF29 MAX	BCF30 MIN	BCF30 MAX	UNITS	TEST CONDITIONS
I_{CBO}	Collector Cutoff Current		100 10		100 10	nA μA	$V_{CB} = 32$ V, $I_E = 0$ $V_{CB} = 32$ V, $I_E = 0$, $T_J = 100°$ C
h_{FE}	DC Current Gain (Note 5)	120	260	215	500		$I_C = 2.0$ mA, $V_{CE} = 5.0$ V
$V_{BE(ON)}$	Base to Emitter Voltage		−0.6		−0.75	V	$I_C = 2.0$ mA, $V_{CE} = 5.0$ V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage		0.3		0.3	V	$I_C = 10$ mA, $I_B = 0.5$ mA
C_c	Collector Capacitance		7.0		7.0	pF	$V_{CB} = 10$ V, $I_E = 0$
NF	Noise Figure		4.0		4.0	dB	$I_C = 200$ μA, $V_{CE} = 5.0$ V, f = 1.0 kHz, BW = 200 Hz

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle μ 1%.
6. For product family characteristic curves, refer to Curve Set T219.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

FAIRCHILD

A Schlumberger Company

BCF70

PNP Low Noise Transistor

- h_{FE} ... **215-500 @ 10 mA**
- V_{CEO} ... **-45 V (Min)**
- **NF ... 4.0 dB (Max)**

PACKAGES

BCF70	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at 25° C Ambient Temperature	0.350 W*

Voltages & Currents (Note 4)

V_{CEO}	Collector to Emitter Voltage	−45 V
V_{CBO}	Collector to Base Voltage	−50 V
V_{CES}	Collector to Emitter Voltage	−50 V
V_{EBO}	Emitter to Base Voltage	−5.0 V
I_C	Collector Current	100 mA
I_{CM}	Collector Current	200 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
I_{CBO}	Collector Cutoff Current		100 10	nA μA	$V_{CB} = -20$ V, $I_E = 0$ $V_{CB} = -20$ V, $I_E = 0$, $T_J = 100°C$
h_{FE}	DC Current Gain (Note 5)	215	500		$I_C = 2.0$ mA, $V_{CE} = -5.0$ V
$V_{CE(sat)}$	Collector-to-Emitter Saturation Voltage		−0.3	V	$I_C = 10$ mA, $I_B = 0.5$ mA
V_{BE}	Base-to-Emitter Voltage	−0.6	−0.75	V	$I_C = 2.0$ mA, $V_{CE} = -5.0$ V
C_c	Collector Capacitance		7.0	pF	$V_{CB} = -10$ V, $I_E = 0$
NF	Noise Figure		4.0	dB	$I_C = 200$ μA, $V_{CE} = -5.0$ V, f = 1.0 kHz, B = 200 Hz

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T219.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

FAIRCHILD

A Schlumberger Company

BCF81

PNP Low Noise Transistor

- h_{FE} ... **420-800 @ 10 mA**
- V_{CEO} ... **-45 V (Min)**
- **NF ... 4.0 dB (Max)**

PACKAGES

BCF81	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at 25° C Ambient Temperature	0.350 W*

Voltages & Currents (Note 4)

V_{CEO}	Collector to Emitter Voltage	−45 V
V_{CBO}	Collector to Base Voltage	−50 V
V_{CES}	Collector to Emitter Voltage	−50 V
V_{EBO}	Emitter to Base Voltage	−5.0 V
I_C	Collector Current	100 mA
I_{CM}	Collector Current	200 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
I_{CBO}	Collector Cutoff Current		100 10	nA μA	$V_{CB} = -20$ V, $I_E = 0$ $V_{CB} = -20$ V, $I_E = 0$, $T_A = 100°$ C
h_{FE}	DC Current Gain (Note 5)	420	800		$I_C = 2.0$ mA, $V_{CE} = -5.0$ V
$V_{CE(sat)}$	Collector-to-Emitter Saturation Voltage		−0.25	V	$I_C = 10$ mA, $I_B = 0.5$ mA
V_{BE}	Base-to-Emitter Voltage	−0.55	−0.7	V	$I_C = 2.0$ mA, $V_{CE} = 5.0$ V
C_c	Collector Capacitance		4.0	pF	$V_{CB} = -10$ V, $I_E = 0$
NF	Noise Figure		4.0	dB	$I_C = 200$ μA, $V_{CE} = -5.0$ V, f = 1.0 kHz, B = 200 Hz

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T155.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

FAIRCHILD

A Schlumberger Company

BCW29/BCW30

PNP General Purpose Transistor

- **P_D . . . 350 mW @ T_A = 25° C**

PACKAGE

BCW29	TO-236AA/AB
BCW30	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at 25° C Ambient Temperature	0.350 W*

Voltages & Currents (Note 4)

V_{CEO}	Collector to Emitter Voltage	20 V
V_{CBO}	Collector to Base Voltage	30 V
V_{EBO}	Emitter to Base Voltage	5.0 V
I_C	Collector Current (Continuous)	100 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage	−20		V	I_C = 2.0 mA, I_E = 0
BV_{CES}	Collector to Emitter Breakdown Voltage	−30		V	I_C = 100 μA, V_{EB} = 0
BV_{CBO}	Collector to Base Breakdown Voltage	−30		V	I_C = 10 μA, I_C = 0
BV_{EBO}	Emitter to Base Breakdown Voltage	−5.0		V	I_E = 10 μA, I_C = 0
I_{CBO}	Collector Cutoff Current		100 10	nA μA	V_{CB} = −20 V, I_E = 0 V_{CB} = −20 V, I_E = 0, T_A = 100° C
h_{FE}	DC Current Gain (BCW29) (Note 5) (BCW30)	120 215	260 500		I_C = 2.0 mA, V_{CE} = −5.0 V I_C = 2.0 mA, V_{CE} = −5.0 V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage		−0.3	V	I_C = 10 mA, I_B = 0.5 mA
$V_{BE(ON)}$	Base to Emitter "On" Voltage	−0.6	−0.75	V	I_C = 2.0 mA, V_{CE} = −5.0 V
C_{ob}	Output Capacitance		7.0	pF	V_{CE} = −10 V, I_E = 0, f = 1.0 MHz
NF	Noise Figure		10	dB	I_C = 0.2 mA, V_{CE} = −5.0 V, f = 1.0 kHz, R_S = 2.0 kΩ, BW = 200 Hz

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T219.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

FAIRCHILD

A Schlumberger Company

BCW32/BCW33

General Purpose Transistor

- P_D ... 350 mW @ T_A = 25° C

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at 25° C Ambient Temperature	0.350 W*

Voltages & Currents (Note 4)

V_{CEO}	Collector to Emitter Voltage	20 V
V_{CBO}	Collector to Base Voltage	30 V
V_{EBO}	Emitter to Base Voltage	5.0 V
I_C	Collector Current (Continuous)	100 mA

PACKAGE

BCW32	TO-236AA/AB
BCW33	TO-236AA/AB

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage	20		V	$I_C = 2.0$ mA, $I_B = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	30		V	$I_C = 10\ \mu A$, $I_B = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0		V	$I_E = 10\ \mu A$, $I_C = 0$
h_{FE}	DC Current Gain (BCW32) (Note 5) (BCW33)	200 420	450 800		$I_C = 2.0$ mA, $V_{CE} = 5.0$ V $I_C = 2.0$ mA, $V_{CE} = 5.0$ V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage		0.25	V	$I_C = 10$ mA, $I_B = 0.5$ mA
$V_{BE(ON)}$	Base to Emitter "On" Voltage	0.55	0.70	V	$I_C = 2.0$ mA, $V_{CE} = 5.0$ V
C_{ob}	Output Capacitance		4.0	pF	$V_{CB} = 10$ V, $I_E = 0$, f = 1.0 MHz
NF	Noise Figure		10	dB	$I_C = 0.2$ mA, $V_{CE} = 5.0$ V, f = 1.0 kHz, $R_S = 2.0\ k\Omega$, BW = 200 Hz

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T155.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

FAIRCHILD

A Schlumberger Company

BCW60A

NPN General Purpose Transistor

- **P_D ... 350 mW @ T_A = 25°C**

PACKAGE

BCW60A	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55°C to 150°C
Operating Junction Temperature	150°C

Power Dissipation (Notes 2 & 3)

Total Dissipation at 25°C Ambient Temperature	0.350 W*

Voltages & Currents (Note 4)

V_{CEO}	Collector to Emitter Voltage	32 V
V_{CBO}	Collector to Base Voltage	32 V
V_{EBO}	Emitter to Base Voltage	5.0 V
I_C	Collector Current (Continuous)	100 mA

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage	32		V	I_C = 2.0 mA, I_E = 0
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0		V	I_E = 1.0 μA, I_C = 0
I_{CES}	Collector Reverse Current		20 20	nA μA	V_{CE} = 32 V V_{CE} = 32 V, T_A = 150°C
I_{EBO}	Emitter Cuttoff Current		20	nA	V_{EB} = 4.0 V, I_C = 0
h_{FE}	DC Current Gain (Note 5)	120 60 125	220 250		I_C = 2.0 mA, V_{CE} = 5.0 V I_C = 50 mA, V_{CE} = 1.0 V I_C = 2.0 mA, V_{CE} = 5.0 V, f = 1.0 kHz
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.55 0.35	V V	I_C = 50 mA, I_B = 1.25 mA I_C = 10 mA, I_B = 0.25 mA

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150°C and junction-to-ambient thermal resistance of 357°C/W (derating factor of 2.8 mW/°C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T144.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)	0.7 0.6	1.05 0.85	V V	$I_C = 50$ mA, $I_B = 1.25$ mA $I_C = 50$ mA, $I_B = 0.25$ mA
$V_{BE(ON)}$	Base to Emitter "On" Voltage	0.55	0.75	V	$I_C = 2.0$ mA, $V_{CE} = 5.0$ V
C_{ob}	Output Capacitance		4.5	pF	$V_{CE} = 10$ V, f = 1.0 MHz
f_T	Current Gain Bandwidth Product		125	MHz	$I_C = 10$ mA, $V_{CE} = 5.0$ V, f = 1.0 MHz
t_{on}	Turn On Time		150	ns	$I_C = 10$ mA, $I_{B1} = 1.0$ mA
t_{off}	Turn Off Time		800	ns	$I_{B2} = 1.0$ mA, $V_{BB} = 3.6$ V, $R_1 = R_2 = 5.0\ \Omega$, $R_L = 990\ \Omega$
NF	Noise Figure		6.0	dB	$I_C = 0.2$ mA, $V_{CE} = 5.0$ V, f = 1.0 kHz, $R_S = 2.0$ kΩ, BW = 200 Hz

3

FAIRCHILD

A Schlumberger Company

BCW61A

PNP General Purpose Transistor

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at 25° C Ambient Temperature	0.350 W*

Voltages & Currents (Note 4)

V_{CEO}	Collector to Emitter Voltage	32 V
V_{CBO}	Collector to Base Voltage	32 V
V_{EBO}	Emitter to Base Voltage	5.0 V
I_C	Collector Current (Continuous)	100 mA

PACKAGE

BCW61A	TO-236AA/AB

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage	−32		V	$I_C = 2.0$ mA, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	−5.0		V	$I_E = 10\ \mu$A, $I_C = 0$
I_{CES}	Collector Reverse Current		20 20	nA μA	$V_{CE} = -32$ V, $V_{BE} = 0$ $V_{CE} = -32$ V, $V_{BE} = 0$, $T_A = 150°$ C
h_{FE}	DC Current Gain	120 60 125	220 250		$I_C = 2.0$ mA, $V_{CE} = -5.0$ V $I_C = 50$ mA, $V_{CE} = -1.0$ V $I_C = 2.0$ mA, $V_{CE} = -5.0$ V, f = 1.0 kHz
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage		−0.55 −0.25	V V	$I_C = 50$ mA, $I_B = 1.25$ mA $I_C = 10$ mA, $I_B = 0.25$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage	−0.68 −0.6	−1.05 −0.85	V V	$I_C = 50$ mA, $I_B = 1.25$ mA $I_C = 10$ mA, $I_B = 0.25$ mA
$V_{BE(ON)}$	Base to Emitter "On" Voltage	−0.6	−0.75	V	$I_C = 2.0$ mA, $V_{CE} = -5.0$ V
C_{ob}	Output Capacitance		6.0	pF	$V_{CE} = -10$ V, $I_C = 0$, f = 1.0 MHz
t_{on}	Turn On Time		150	ns	$I_C = 10$ mA, $I_{B1} = 1.0$ mA
t_{off}	Turn Off Time		800	ns	$I_{B2} = 1.0$ mA, $V_{BB} = -3.6$ V, $R_1 = R_2 = 5.0\ \Omega$, $R_L = 990\ \Omega$
NF	Noise Figure		6.0	dB	$I_C = 0.2$ mA, $V_{CE} = -5.0$ V, f = 1.0 kHz, $R_S = 2.0$ kΩ, BW = 200 Hz

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T215.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

FAIRCHILD

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BCW65A

NPN Silicon General Purpose Transistor

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at 25° C Ambient Temperature	0.350 W*

Voltages & Currents (Note 4)

V_{CEO}	Collector to Emitter Voltage	32 V
V_{CBO}	Collector to Base Voltage	60 V
V_{EBO}	Emitter to Base Voltage	5.0 V
I_C	Collector Current (Continuous)	800 mA

PACKAGE

BCW65A	TO-236AA/AB

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage	32		V	$I_C = 10$ mA, $I_B = 0$
BV_{CES}	Collector to Emitter Breakdown Voltage	60		V	$I_C = 10$ μA, $V_{EB} = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0		V	$I_E = 10$ μA, $I_C = 0$
I_{EBO}	Emitter Cutoff Current		20	nA	$V_{EB} = 4.0$ V, $I_C = 0$
I_{CES}	Collector Reverse Current		20 20	nA μA	$V_{CE} = 32$ V, $I_E = 0$ $V_{CE} = 32$ V, $I_E = 0$, $T_A = 150°$ C
h_{FE}	DC Current Gain (Note 5)	35 75 100 35	 220 250 		$I_C = 100$ μA, $V_{CE} = 10$ V $I_C = 10$ mA, $V_{CE} = 1.0$ V $I_C = 100$ mA, $V_{CE} = 1.0$ V $I_C = 500$ mA, $V_{CE} = 2.0$ V
$V_{BE(sat)}$	Base to Emitter Saturation Voltage		2.0	V	$I_C = 500$ mA, $I_B = 50$ mA
C_{ob}	Output Capacitance		12	pF	$V_{CB} = 10$ V, $I_E = 0$, f = 1.0 MHz
C_{ib}	Input Capacitance		80	pF	$V_{EB} = 0.5$ V, $I_C = 0$, f = 1.0 MHz
f_T	Current Gain Bandwidth Product	100		MHz	$V_{CE} = 10$ V, $I_C = 20$ mA, f = 100 MHz
t_{on}	Turn On Time		100	ns	$I_{B1} = I_{B2} = 15$ mA
t_{off}	Turn Off Time		400	ns	$I_C = 150$ mA, $R_L = 150\ \Omega$
NF	Noise Figure		10	dB	$I_C = 0.2$ mA, $V_{CE} = 5.0$ V, f = 1.0 kHz, $R_S = 1.0$ kΩ, BW = 200 Hz

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T145.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

FAIRCHILD

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BCW66F

NPN General Purpose Transistor

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at 25° C Ambient Temperature	0.350 W*

Voltages & Currents (Note 4)

V_{CEO}	Collector to Emitter Voltage	45 V
V_{CBO}	Collector to Base Voltage	75 V
V_{EBO}	Emitter to Base Voltage	5.0 V
I_C	Collector Current (Continuous)	800 mA

PACKAGE

BCW66F	TO-236AA/AB

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage	45		V	$I_C = 10$ mA, $I_B = 0$
BV_{CES}	Collector to Emitter Breakdown Voltage	75		V	$I_C = 10\ \mu A$, $V_{EB} = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0		V	$I_E = 10\ \mu A$, $I_C = 0$
I_{EBO}	Emitter Cutoff Current		20	nA	$V_{EB} = 4.0$ V, $I_C = 0$
I_{CES}	Collector Reverse Current		20 20	nA μA	$V_{CE} = 45$ V, $I_C = 0$ $V_{CE} = 45$ V, $I_C = 0$, $T_A = 150°$ C
h_{FE}	DC Current Gain (Note 5)	35 75 100 35	 250 		$I_C = 100\ \mu A$, $V_{CE} = 10$ V $I_C = 10$ mA, $V_{CE} = 1.0$ V $I_C = 100$ mA, $V_{CE} = 1.0$ V $I_C = 500$ mA, $V_{CE} = 2.0$ V
$V_{BE(sat)}$	Base to Emitter Saturation Voltage		2.0	V	$I_C = 500$ mA, $I_B = 50$ mA
C_{ob}	Output Capacitance		12	pF	$V_{CB} = 10$ V, $I_E = 0$, f = 1.0 MHz
C_{ib}	Input Capacitance		80	pF	$V_{EB} = 0.5$ V, $I_C = 0$, f = 1.0 MHz
f_T	Current Gain Bandwidth Product	100		MHz	$V_{CE} = 10$ V, $I_C = 20$ mA, f = 100 MHz
t_{on}	Turn On Time		100	ns	$I_{B1} = I_{B2} = 15$ mA
t_{off}	Turn Off Time		400	ns	$I_C = 150$ mA, $R_L = 150\ \Omega$
NF	Noise Figure		10	dB	$I_C = 0.2$ mA, $V_{CE} = 5.0$ V, f = 1.0 kHz, $R_S = 1.0$ kΩ, BW = 200 Hz

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T145.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

FAIRCHILD

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BCW69/BCW70

PNP General Purpose Transistor

- **P_D ... 350 mW @ T_A = 25° C**

PACKAGE

BCW69	TO-236AA/AB
BCW70	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at 25° C Ambient Temperature	0.350 W*

Voltages & Currents (Note 4)

V_{CEO}	Collector to Emitter Voltage	−45 V
V_{EBO}	Emitter to Base Voltage	−5.0 V
I_C	Collector Current (Continuous)	100 mA

3

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage	−45		V	I_C = 2.0 mA, I_B = 0
BV_{CES}	Collector to Emitter Breakdown Voltage	−50		V	I_C = 100 μA, V_{EB} = 0
BV_{EBO}	Emitter to Base Breakdown Voltage	−5.0		V	I_E = 10 μA, I_C = 0
I_{CBO}	Collector Cutoff Current		100 10	nA μA	V_{CB} = −20 V, I_E = 0 V_{CB} = −20 V, I_E = 0, T_A = 100° C
h_{FE}	DC Current Gain (BCW69) (Note 5) (BCW70)	120 215	260 500		I_C = 2.0 mA, V_{CE} = −5.0 V I_C = 2.0 mA, V_{CE} = −5.0 V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage		−0.3	V	I_C = 10 mA, I_B = 0.5 mA
$V_{BE(ON)}$	Base to Emitter "On" Voltage	−0.6	−0.75	V	I_C = 2.0 mA, V_{CE} = −5.0 V
C_{ob}	Output Capacitance		7.0	pF	V_{CB} = −10 V, I_E = 0, f = 1.0 MHz
NF	Noise Figure		10	dB	I_C = 0.2 mA, V_{CE} = −5.0 V, f = 1.0 kHz, R_S = 20 Ω BW = 200 Hz

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T219.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

FAIRCHILD
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BCW72

NPN General Purpose Transistor

- **P_D ... 350 mW @ T_A = 25° C**

PACKAGE

BCW72	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at 25° C Ambient Temperature	0.350 W*

Voltages & Currents (Note 4)

V_{CEO}	Collector to Emitter Voltage	45 V
V_{CBO}	Collector to Base Voltage	50 V
V_{EBO}	Emitter to Base Voltage	5.0 V
I_C	Collector Current (Continuous)	100 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage	45		V	$I_C = 2.0$ mA, $V_{EB} = 0$
BV_{CES}	Collector to Emitter Breakdown Voltage	45		V	$I_C = 2.0$ mA, $V_{EB} = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	50		V	$I_C = 10$ μA, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0		V	$I_E = 10$ μA, $I_C = 0$
I_{CBO}	Collector Cutoff Current		100 10	nA μA	$V_{CB} = 20$ V, $I_E = 0$ $V_{CB} = 20$ V, $I_E = 0$, $T_A = 100°$ C
h_{FE}	DC Current Gain (Note 5)	200	450		$I_C = 2.0$ mA, $V_{CE} = 5.0$ V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage		0.25	V	$I_C = 10$ mA, $I_B = 0.5$ mA
$V_{BE(ON)}$	Base to Emitter "On" Voltage	0.6	0.75	V	$I_C = 2.0$ mA, $V_{CE} = 5.0$ V
C_{ob}	Output Capacitance		4.0	pF	$V_{CB} = 10$ V, $I_E = 0$, f = 1.0 MHz
NF	Noise Figure		10	dB	$I_C = 0.2$ mA, $V_{CE} = 5.0$ V, f = 1.0 kHz, $R_S = 2.0$ Ω BW = 200 Hz

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T155.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

BCW81

NPN Transistor

- h_{FE} . . . 420-800
- V_{CEO} . . . 45 V (Max)
- NF . . . 10 dB (Max)

PACKAGE

BCW81	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at 25° C Ambient Temperature	0.350 W*

Voltages & Currents (Note 4)

V_{CEO}	Collector to Emitter Voltage	45 V
V_{CBO}	Collector to Base Voltage	50 V
V_{EBO}	Emitter to Base Voltage	5.0 V
I_C	Collector Current	100 mA
I_{CM}	Collector Current	200 mA

3

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
I_{CBO}	Collector Cutoff Current		100 10	nA μA	$V_{CB} = 20$ V, $I_E = 0$ $V_{CB} = 20$ V, $I_E = 0$, $T_A = 100°$C
h_{FE}	DC Current Gain (Note 5)	420	800		$I_C = 2.0$ mA, $V_{CE} = 5.0$ V
$V_{CE(sat)}$	Collector-to-Emitter Saturation Voltage		0.25	V	$I_C = 10$ mA, $I_B = 0.5$ mA
V_{BE}	Base-to-Emitter Voltage	0.55	0.7	V	$I_C = 2.0$ mA, $V_{CE} = 5.0$ V
C_c	Collector Capacitance		4.0	pF	$V_{CB} = 10$ V, $I_E = 0$
NF	Noise Figure		4.0	dB	$I_C = 200$ μA, $V_{CE} = -5.0$ V, f = 1.0 kHz, B = 200 Hz

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T155.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

FAIRCHILD
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BCX70G/BCX70H/BCX70J

NPN General Purpose Transistor

- **P_D ... 350 mW @ T_A = 25° C**

PACKAGE

BCX70G	TO-236AA/AB
BCX70H	TO-236AA/AB
BCX70J	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at 25° C Ambient Temperature	0.350 W*

Voltages & Currents (Note 4)

V_{CEO}	Collector to Emitter Voltage	45 V
V_{CBO}	Collector to Base Voltage	45 V
V_{EBO}	Emitter to Base Voltage	5.0 V
I_C	Collector Current (Continuous)	100 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage	45		V	$I_C = 2.0$ mA, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0		V	$I_E = 10\ \mu$A, $I_C = 0$
I_{EBO}	Emitter Cutoff Current		20	nA	$V_{EB} = 4.0$ V, $I_C = 0$
I_{CES}	Collector Cutoff Current		20	nA	$V_{CE} = 32$ V
			20	μA	$V_{CE} = 32$ V, $T_A = 150°$ C
h_{FE}	DC Current Gain (Note 5)				
	(BCX70H)	20			$I_C = 10\ \mu$A, $V_{CE} = 5.0$ V
	(BCX70J)	40			$I_C = 10\ \mu$A, $V_{CE} = 5.0$ V
	(BCX70G)	120	220		$I_C = 2.0$ mA, $V_{CE} = 5.0$ V
	(BCX70H)	180	310		$I_C = 2.0$ mA, $V_{CE} = 5.0$ V
	(BCX70J)	250	460		$I_C = 2.0$ mA, $V_{CE} = 5.0$ V
	(BCX70G)	60			$I_C = 50$ mA, $V_{CE} = 1.0$ V
	(BCX70H)	70			$I_C = 50$ mA, $V_{CE} = 1.0$ V
	(BCX70J)	90			$I_C = 50$ mA, $V_{CE} = 1.0$ V

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T144.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage		0.35 0.55	V V	I_C = 10 mA, I_B = 0.25 mA I_C = 50 mA, I_B = 1.25 mA
$V_{BE(ON)}$	Base to Emitter "On" Voltage	0.55	0.75	V	I_C = 2.0 mA, V_{CE} = 5.0 V
$V_{BE(sat)}$	Base to Emitter Saturation Voltage	0.6 0.7	0.85 1.05	V V	I_C = 50 mA, I_B = 0.25 mA I_C = 50 mA, I_B = 1.25 mA
C_{ob}	Output Capacitance		4.5	pF	V_{CE} = 10 V, I_C = 0, f = 1.0 MHz
h_{fe}	Small Signal Current Gain (BCX70G) (BCX70H) (BCX70J)	125 175 250	250 350 500		I_C = 2.0 mA, V_{CE} = 5.0 V, f = 1.0 MHz I_C = 2.0 mA, V_{CE} = 5.0 V, f = 1.0 MHz I_C = 2.0 mA, V_{CE} = 5.0 V, f = 1.0 MHz
f_T	Current Gain Bandwidth Product		125	MHz	I_C = 10 mA, V_{CE} = 5.0 mA, f = 100 MHz
t_{on}	Turn On Time		150	ns	I_C = 10 mA, I_{B1} = 1.0 mA
t_{off}	Turn Off Time		800	ns	I_{B2} = 1.0 mA, V_{BB} = 3.6 V, R1 = R2 = 5.0 kΩ, R_L = 990 Ω
NF	Noise Figure		6.0	dB	I_C = 0.2 mA, V_{CE} = 5.0 V, f = 1.0 kHz, R_S = 2.0 kΩ, BW = 200 Hz

FAIRCHILD

A Schlumberger Company

BCX71H/BCX71J/BCX71K

PNP General Purpose Transistor

- **P_D ... 350 mW @ T_A = 25°C**

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55°C to 150°C
Operating Junction Temperature	150°C

Power Dissipation (Notes 2 & 3)

Total Dissipation at 25°C Ambient Temperature	0.350 W*

Voltages & Currents (Note 4)

V_{CEO}	Collector to Emitter Voltage	−45 V
V_{CBO}	Collector to Base Voltage	−45 V
V_{EBO}	Emitter to Base Voltage	−5.0 V
I_C	Collector Current (Continuous)	100 mA

PACKAGE

BCX71H	TO-236AA/AB
BCX71J	TO-236AA/AB
BCX71K	TO-236AA/AB

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage	−45		V	$I_C = 2.0$ mA, $I_B = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	−5.0		V	$I_E = 1.0$ μA, $I_C = 0$
I_{CES}	Collector Cutoff Current		20	nA	$V_{CE} = -32$ V
			20	μA	$V_{CE} = -32$ V, $T_A = 150°C$
h_{FE}	DC Current Gain (Note 5)				
	(BCX71H)	30			$I_C = 10$ μA, $V_{CE} = -5.0$ V
	(BCX71J)	40			$I_C = 10$ μA, $V_{CE} = -5.0$ V
	(BCX71K)	100			$I_C = 10$ μA, $V_{CE} = -5.0$ V
	(BCX71H)	180	310		$I_C = 2.0$ mA, $V_{CE} = -5.0$ V
	(BCX71J)	250	460		$I_C = 2.0$ mA, $V_{CE} = -5.0$ V
	(BCX71K)	380	630		$I_C = 2.0$ mA, $V_{CE} = -5.0$ V
	(BCX71H)	80			$I_C = 50$ mA, $V_{CE} = -1.0$ V
	(BCX71J)	100			$I_C = 50$ mA, $V_{CE} = -1.0$ V

NOTES

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150()C and junction-to-ambient thermal resistance of 357()C/W (derating factor of 2.8 mW/()C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length μ 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T219.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
	(BCX71K) (BCX71H) (BCX71J) (BCX71K)	110 175 250 350	 350 500 700		$I_C = 50$ mA, $V_{CE} = -1.0$ V $I_C = 2.0$ mA, $V_{CE} = -5.0$ V, f = 1.0 kHz $I_C = 2.0$ mA, $V_{CE} = -5.0$ V, f = 1.0 kHz $I_C = 2.0$ mA, $V_{CE} = -5.0$ V, f = 1.0 kHz
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage		−0.25 −0.55	V V	$I_C = 10$ mA, $I_B = 0.25$ mA $I_C = 50$ mA, $I_B = 1.25$ mA
$V_{BE(ON)}$	Base to Emitter "On" Voltage	−0.6	−0.75	V	$I_C = 2.0$ mA, $V_{CE} = -5.0$ V
$V_{BE(sat)}$	Base to Emitter Saturation Voltage	−0.6 −0.68	−0.85 −1.05	V V	$I_C = 10$ mA, $I_B = 0.25$ mA $I_C = 50$ mA, $I_B = 1.25$ mA
C_{ob}	Output Capacitance		6.0	pF	$V_{CE} = -10$ V, $I_C = 0$, f = 1.0 MHz
t_{on}	Turn On Time		150	ns	$I_C = 10$ mA, $I_{B1} = 1.0$ mA
t_{off}	Turn Off Time		800	ns	$I_{B2} = 1.0$ mA, $V_{BB} = -3.6$ V, R1 = R2 = 5.0 kΩ, $R_L = 990$ Ω
NF	Noise Figure		6.0	dB	$I_C = 0.2$ mA, $V_{CE} = -5.0$ V, f = 1.0 kHz, $R_S = 2.0$ kΩ, BW = 200 Hz

3

FAIRCHILD

A Schlumberger Company

BSR13/BSR14

NPN Switching Transistor

- V_{CEO} ... **BSR13 30 V (Max), BSR14 40 V (Max)**
- f_T ... **BSR13 250 MHz (Min), BSR14 300 MHz (Min)**

PACKAGE	
BSR13	TO-236AA/AB
BSR14	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation

Total Dissipation at 25° C Ambient Temperature	0.350 W*

Voltages & Currents		**BSR13**	**BSR14**
V_{CEO}	Collector to Emitter Voltage	30 V	40 V
V_{CBO}	Collector to Base Voltage	60 V	75 V
V_{EBO}	Emitter to Base Voltage	5.0 V	6.0 V
I_C	Collector Current	800 mA	800 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	BSR13 MIN	BSR13 MAX	BSR14 MIN	BSR14 MAX	UNITS	TEST CONDITIONS
I_{CBO}	Collector Cutoff Current		30			nA	$V_{CB} = 50$ V, $I_E = 0$
					10	nA	$V_{CB} = 60$ V, $I_E = 0$
			10			μA	$V_{CB} = 50$ V, $I_E = 0$, $T_A = 150°$ C
					10	μA	$V_{CB} = 60$ V, $I_E = 0$, $T_A = 150°$ C
I_{CEX}	Collector Reverse Current				10	nA	$V_{CE} = 60$ V, $V_{EB} = 3.0$ V
I_{BEX}	Base Reverse Current				20	nA	$V_{CE} = 60$ V, $V_{EB} = 3.0$ V
I_{EBO}	Emitter Cutoff Current		30		15	nA	$V_{EB} = 3.0$ V, $I_C = 0$

NOTES:
1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T145.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	BSR13 MIN	BSR13 MAX	BSR14 MIN	BSR14 MAX	UNITS	TEST CONDITIONS
h_{FE}	DC Current Gain	35		35			$I_C = 0.1$ mA, $V_{CE} = 10$ V
		50		50			$I_C = 1.0$ mA, $V_{CE} = 10$ V
		75		75			$I_C = 10$ mA, $V_{CE} = 10$ V
		100	300	100	300		$I_C = 150$ mA, $V_{CE} = 10$ V
		50		50			$I_C = 150$ mA, $V_{CE} = 10$ V
		30					$I_C = 500$ mA, $V_{CE} = 10$ V
				40			$I_C = 500$ mA, $V_{CE} = 10$ V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage		400		300	mV	$I_C = 150$ mA, $I_B = 15$ mA
			1.6		1.0	V	$I_C = 500$ mA, $I_B = 50$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage		1.3			V	$I_C = 150$ mA, $I_B = 15$ mA
			0.6		1.2	V	$I_C = 150$ mA, $I_B = 15$ mA
			2.6		2.0	V	$I_C = 500$ mA, $I_B = 15$ mA
C_c	Collector Capacitance		8.0		8.0	pF	$V_{CB} = 10$ V, $I_E = 0$
f_T	Current Gain Bandwidth Product	250		300		MHz	$V_{CE} = 20$ mA, $I_C = 20$ mA
h_{fe}	Small Signal Current Gain			50	300		$I_C = 1.0$ mA, $V_{CE} = 10$ V
				75	375		$I_C = 10$ mA, $V_{CE} = 10$ V
h_{ie}	Input Impedance			2.0	8.0	kΩ	$I_C = 1.0$ mA, $V_{CE} = 10$ V
				0.25	1.25	kΩ	$I_C = 10$ mA, $V_{CE} = 10$ V
h_{oe}	Output Conductance			5.0	35	μmhos	$I_C = 1.0$ mA, $V_{CE} = 10$ V
				25	200	μmhos	$I_C = 10$ mA, $V_{CE} = 10$ V
h_{re}	Voltage Feedback Ration				8.0	$\times 10^{-4}$	$I_C = 1.0$ mA, $V_{CE} = 10$ V
					4.0	$\times 10^{-4}$	$I_C = 10$ mA, $V_{CE} = 10$ V
t_d	Turn On Delay Time				10	ns	$I_C = 150$ mA
t_r	Rise Time				25	ns	$I_C = 150$ mA
t_s	Storage Time				225	ns	$I_C = 150$ mA
t_f	Fall Time				60	ns	$I_C = 150$ mA

FAIRCHILD

A Schlumberger Company

BSR15/BSR16

PNP Switching Transistor

- V_{CEO} ... **BSR15 40 V (Max), BSR16 60 V (Max)**
- f_T ... **> 200 MHz**
- t_{on} ... **< 45 ns**
- t_{on} ... **< 100 μs**

PACKAGE

BSR15	TO-236AA/AB
BSR16	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at 25° C Ambient Temperature	0.350 W*

Voltages & Currents

		BSR15	BSR16
V_{CEO}	Collector to Emitter Voltage (Note 4)	−40 V	−60 V
V_{CBO}	Collector to Base Voltage	−60 V	−60 V
V_{EBO}	Emitter to Base Voltage	−5.0 V	−5.0 V
I_C	Collector Current	600 mA	600 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	BSR15 MIN	BSR15 MAX	BSR16 MIN	BSR16 MAX	UNITS	TEST CONDITIONS
I_{CBO}	Collector Cutoff Current		20		10	nA	$V_{CB} = -50$ V, $I_E = 0$
			20		10	μA	$V_{CB} = -50$ V, $I_E = 0$, $T_A = 150°$ C
I_{CEX}	Collector Cutoff Current		50		50	nA	$V_{CE} = -30$ V, $V_{EB} = 0.5$ V
I_{BEX}	Base Reverse Current		50		50	nA	$V_{CE} = -30$ V, $V_{EB} = 3.0$ V
h_{FE}	DC Current Gain (Note 5)	35		75			$I_C = 0.1$ mA, $V_{CE} = -10$ V
		50		100			$I_C = 1.0$ mA, $V_{CE} = -10$ V
		75		100			$I_C = 10$ mA, $V_{CE} = -10$ V
		100	300	100	300		$I_C = 150$ mA, $V_{CE} = -10$ V
		30		50			$I_C = 500$ mA, $V_{CE} = -10$ V

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle μ 1%.
6. For product family characteristic curves, refer to Curve Set T212.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	BSR15 MIN	BSR15 MAX	BSR16 MIN	BSR16 MAX	UNITS	TEST CONDITIONS
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		−0.4 −1.6		−0.4 −1.6	V V	I_C = 150 mA, I_B = 15 mA I_C = 500 mA, I_B = 50 mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)		−1.3 −2.6		−1.3 −2.6	V V	I_C = 150 mA, I_B = 15 mA I_C = 500 mA, I_B = 50 mA
C_c	Collector Capacitance		8.0		8.0	pF	V_{CB} = −10 mA, I_E = I_e = 0
C_e	Emitter Capacitance		30		30	pF	V_{EB} = −2.0 V, I_C = 0
f_T	Current Gain Bandwidth Product	200				MHz	V_{CE} = 20 mA, I_C = 50 mA, T_A = 25° C
t_d	Turn On Delay Time		10		10	ns	I_C = 150 mA, I_B = 15 mA
t_r	Rise Time		40		40	ns	I_C = 150 mA, I_B = 15 mA
t_s	Storage Time		80		80	ns	I_C = 150 mA, I_B = 15 mA I_{BM} = 15 mA
t_f	Fall Time		30		30	ns	I_C = 150 mA, I_B = 15 mA I_{BM} = 15 mA
t_{on}	Turn On Time		45		45	ns	I_C = 150 mA, I_B = 15 mA
t_{off}	Turn Off Time		100		100	ns	I_C = 150 mA, I_B = 15 mA I_{BM} = 15 mA

FAIRCHILD

A Schlumberger Company

BSR17

NPN Switching Transistor

- V_{CEO} . . . **40 V (Max)**
- f_T . . . **250 MHz (Min)**

PACKAGES

BSR17	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation

Total Dissipation at 25° C Ambient Temperature	0.350 W*

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage	40 V
V_{CBO}	Collector to Base Voltage	60 V
V_{EBO}	Emitter to Base Voltage	6.0 V
I_C	Collector Current	200 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
I_{CBO}	Collector Cutoff Current		5.0	μA	$V_{CB} = 50$ V, $I_E = 0$, $T_J = 150°$ C
I_{CEX}	Collector Cutoff Current		50	nA	$V_{CE} = 30$ V, $V_{EB} = 3.0$ V
I_{BX}	Base Current		50	nA	$V_{CE} = 30$ V, $V_{EB} = 3.0$ V
h_{FE}	DC Current Gain	20 35 50 30 15	 150 		$I_C = 0.1$ mA, $V_{CE} = 1.0$ V $I_C = 1.0$ mA, $V_{CE} = 1.0$ V $I_C = 10$ mA, $V_{CE} = 1.0$ V $I_C = 50$ mA, $V_{CE} = 1.0$ V $I_C = 100$ mA, $V_{CE} = 1.0$ V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage		200 300	V V	$I_C = 10$ mA, $I_B = 1.0$ mA $I_C = 50$ mA, $I_B = 5.0$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage	650	850 950	V V	$I_C = 10$ mA, $I_B = 1.0$ mA $I_C = 50$ mA, $I_B = 5.0$ mA

NOTES:
1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T144.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
f_T	Current Gain Bandwidth Product	250		MHz	V_{CE} = 20 mA, I_C = 10 mA
h_{fe}	Small Signal Current Gain	50	200		I_C = 10 mA, V_{CE} = 20 V, f = 1.0 kHz
h_{ie}	Input Impedance	1.0 0.1	8.0 5.0	kΩ kΩ	I_C = 10 mA, V_{CE} = 20 V, f = 1.0 kHz I_C = 10 mA, V_{CE} = 20 V, f = 1.0 kHz
h_{oe}	Output Conductance	1.0	40	μmhos	I_C = 10 mA, V_{CE} = 20 V, f = 1.0 kHz
t_d	Turn On Delay Time		35	ns	I_C = 10 mA, I_B = 1.0 mA, V_{EB} = 0.5 V
t_r	Rise Time		35	ns	I_C = 10 mA, I_B = 1.0 mA, V_{EB} = 0.5 V
t_s	Storage Time		175	ns	I_C = 10 mA, I_{Bon} = -I_{Boff} = 1.0 mA
t_f	Fall Time		50	ns	I_C = 10 mA, I_{Bon} = -I_{Boff} = 1.0 mA

FAIRCHILD

A Schlumberger Company

BSS63

PNP High Voltage Transistor

- **P_D ... 350 mW @ T_A = 25° C**

PACKAGE

BSS63 TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature -55° C to 150° C

Operating Junction Temperature 150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at 25° C Ambient Temperature 0.350 W*

Voltages & Currents (Note 4)

V_{CEO}	Collector to Emitter Voltage	−100 V
V_{CER}	Collector to Emitter Voltage R_{BE} = 10 kΩ	−110 V
I_C	Collector Current (Continuous)	100 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage	−100		V	I_C = 100 μA
BV_{CBO}	Collector to Base Breakdown Voltage	−110		V	I_C = 10 μA
BV_{CER}	Collector to Emitter Breakdown Voltage	−110		V	I_C = 10 μA, I_E = 0, R_{BE} = 10 kΩ
BV_{EBO}	Emitter to Base Breakdown Voltage	−6.0		V	I_E = 10 μA
I_{EBO}	Emitter Cutoff Current		200	nA	V_{EB} = −6.0 V, I_C = 0
I_{CBO}	Collector Cutoff Current		100	nA	V_{CB} = −90 V, I_E = 0
I_{CER}	Collector Cutoff Current		10	μA	V_{CE} = −110 V, R_{BE} = 10 Ω
h_{FE}	DC Current Gain (Note 5)	30 30			I_C = 10 mA, V_{CE} = −1.0 V I_C = 25 mA, V_{CE} = −1.0 V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage		−250	mV	I_C = 25 mA, I_B = 25 mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage		−900	V	I_C = 25 mA, I_B = 2.5 mA
f_T	Current Gain Bandwidth Product	50		MHz	V_{CE} = −5.0 V, I_C = 25 mA, f = 35 MHz
C_C	Case Capacitance		5.0	pF	I_E = I_C = 0, V_{CB} = −10 V

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T232.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

FAIRCHILD

A Schlumberger Company

BSS64

NPN Driver Transistor

- P_D ... 350 mW @ T_A = 25°C

PACKAGE

BSS64	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55°C to 150°C
Operating Junction Temperature	150°C

Power Dissipation (Notes 2 & 3)

Total Dissipation at 25°C Ambient Temperature	0.350 W*

Voltages & Currents (Note 4)

V_{CEO}	Collector to Emitter Voltage	80 V
V_{CBO}	Collector to Base Voltage	120 V
V_{EBO}	Emitter to Base Voltage	5.0 V
I_C	Collector Current (Continuous)	100 mA

3

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage	80		V	I_C = 4.0 mA, I_E = 0
BV_{CBO}	Collector to Base Breakdown Voltage	120		V	I_C = 100 μA
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0		V	I_E = 100 μA
I_{EBO}	Emitter Cutoff Current		200	nA	V_{EB} = 4.0 V
I_{CES}	Collector Cutoff Current		20	μA	V_{CE} = 80 V, T_A = 70°C
h_{FE}	DC Current Gain (Note 5)	20			I_C = 10 mA, V_{CE} = 1.0 V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.7 3.0	V V	I_C = 4.0 mA, I_B = 400 μA I_C = 50 mA, I_B = 15 mA
f_T	Current Gain Bandwidth Product		50	MHz	I_C = 4.0 mA, V_{CE} = 10 V, f = 35 MHz

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150°C and junction-to-ambient thermal resistance of 357°C/W (derating factor of 2.8 mW/°C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T149.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

BSS79B/BSS79C

PNP General Purpose Transistor

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at 25° C Ambient Temperature	0.350 W*

Voltages & Currents (Note 4)

V_{CEO}	Collector to Emitter Voltage	40 V
V_{CBO}	Collector to Base Voltage	75 V
V_{EBO}	Emitter to Base Voltage	6.0 V
I_C	Collector Current (Continuous)	100 mA

PACKAGE

BSS79B	TO-236AA/AB
BSS79C	TO-236AA/AB

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage	40		V	$I_C = 2.0$ mA
BV_{CBO}	Collector to Base Breakdown Voltage	75		V	$I_C = 10\ \mu A$
BV_{EBO}	Emitter to Base Breakdown Voltage	6.0		V	$I_E = 10\ \mu A$
I_{EBO}	Emitter Cutoff Current		10	nA	$V_{BE} = 3.0$ V
I_{CBO}	Collector Cutoff Current		10 10	nA μA	$V_{CB} = 60$ V $V_{CB} = 60$ V, $T_A = 150°$ C
h_{FE}	DC Current Gain (BSS79B) (Note 5) (BSS79C)	40 100	120 300		$I_C = 150$ mA, $V_{CE} = 10$ V $I_C = 150$ mA, $V_{CE} = 10$ V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.3 1.0	V V	$I_C = 150$ mA, $I_B = 15$ mA $I_C = 500$ mA, $I_B = 50$ mA
C_{ob}	Output Capacitance		8.0	pF	$V_{CB} = 10$ V, f = 1.0 MHz
f_T	Current Gain Bandwidth Product	250		MHz	$V_{CE} = 20$ V, $I_C = 20$ mA, f = 100 MHz
t_d	Turn On Delay Time		10	ns	$I_C = 150$ mA, $V_{CC} = 30$ V, $I_{B1} = I_{B2} = 15$ mA
t_r	Rise Time		10	ns	$I_C = 150$ mA, $V_{CC} = 30$ V, $I_{B1} = I_{B2} = 15$ mA
t_s	Storage Time		225	ns	$I_C = 150$ mA, $V_{CC} = 30$ V, $I_{B1} = I_{B2} = 15$ mA
t_f	Fall Time		60	ns	$I_C = 150$ mA, $V_{CC} = 30$ V, $I_{B1} = I_{B2} = 15$ mA

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T145.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

FAIRCHILD

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BSS80B/BSS80C

PNP General Purpose Transistor

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at 25° C Ambient Temperature	0.350 W*

Voltages & Currents (Note 4)

V_{CEO}	Collector to Emitter Voltage	−40 V
V_{CBO}	Collector to Base Voltage	−60 V
V_{EBO}	Emitter to Base Voltage	−5.0 V
I_C	Collector Current (Continuous)	800 mA

PACKAGE

BSS80B	TO-236AA/AB
BSS80C	TO-236AA/AB

3

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage	−40		V	$I_C = 10$ mA
BV_{CBO}	Collector to Base Breakdown Voltage	−60		V	$I_C = 10\ \mu A$
BV_{EBO}	Emitter to Base Breakdown Voltage	−5.0		V	$I_E = 10\ \mu A$
I_{EBO}	Emitter Cutoff Current		10	nA	$V_{BE} = -3.0$ V
I_{CBO}	Collector Cutoff Current		10 10	nA μA	$V_{CB} = -50$ V $V_{CB} = -50$ V, $T_A = 150°$ C
h_{FE}	DC Current Gain (BSS80B) (Note 5) (BSS80C)	40 100	120 300		$I_C = 150$ mA, $V_{CE} = -10$ V $I_C = 150$ mA, $V_{CE} = -10$ V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		−0.4 −1.6	V V	$I_C = 150$ mA, $I_B = 15$ mA $I_C = 500$ mA, $I_B = 50$ mA
C_{ob}	Output Capacitance		8.0	pF	$V_{CB} = -10$ V, f = 1.0 MHz
f_T	Current Gain Bandwidth Product	200		MHz	$V_{CE} = -20$ V, $I_C = 50$ mA, f = 100 MHz
t_d	Turn On Delay Time		10	ns	$I_C = 150$ mA, $V_{CC} = -30$ V, $I_{B1} = I_{B2} = 15$ mA
t_r	Rise Time		40	ns	$I_C = 150$ mA, $V_{CC} = -30$ V, $I_{B1} = I_{B2} = 15$ mA
t_s	Storage Time		80	ns	$I_C = 150$ mA, $V_{CC} = -30$ V, $I_{B1} = I_{B2} = 15$ mA
t_f	Fall Time		30	ns	$I_C = 150$ mA, $V_{CC} = -30$ V, $I_{B1} = I_{B2} = 15$ mA

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T212.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

FAIRCHILD
A Schlumberger Company

BSV52

NPN Silicon Switching Transistor

- **P_D ... 350 mW @ T_A = 25° C**

PACKAGE

BSV52	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at 25° C Ambient Temperature	0.350 W*

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	12 V
V_{CBO}	Collector to Base Voltage	20 V
V_{EBO}	Emitter to Base Voltage	20 V
I_C	Collector Current (Continuous)	200 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage	12		V	I_C = 1.0 mA, I_B = 0
I_{CBO}	Collector Cutoff Current		100 5.0	nA μA	V_{CB} = 10 V, I_E = 0 V_{CB} = 10 V, I_E = 0, T_A = 125° C
h_{FE}	DC Current Gain	25 40 25	 120 		I_C = 1.0 mA, V_{CE} = 1.0 V I_C = 10 mA, V_{CE} = 1.0 V I_C = 50 mA, V_{CE} = 1.0 V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		300 250 400	mV mV mV	I_C = 10 mA, I_B = 300 μA I_C = 10 mA, I_B = 1.0 mA I_C = 50 mA, I_B = 5.0 mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage	700	850 1200	mV mV	I_C = 10 mA, I_B = 1.0 mA I_C = 50 mA, I_B = 5.0 mA
C_{ob}	Output Capacitance		4.0	pF	V_{CB} = 5.0 V, I_E = 0, f = 1.0 MHz
C_{ib}	Input Capacitance		4.5	pF	V_{EB} = 1.0 V, I_C = 0
f_T	Current Gain Bandwidth Product	400		MHz	V_{CE} = 10 V, I_C = 10 mA
t_s	Storage Time (test circuit no. 239)		13	ns	I_C = 10 mA, I_B = I_{BM} = 10 mA
t_{on}	Turn On Time		12	ns	I_C = 10 mA, V_{BE} = 1.5 V, I_B = 3.0 mA
t_{off}	Turn Off Time		18	ns	I_C = 10 mA, I_B = 3.0 mA

NOTES:
1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T132.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

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BSX39

NPN Silicon Switching Transistor

- **P_D . . . 350 mW @ T_A = 25° C**

PACKAGE

BSX39 TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at 25° C Ambient Temperature	0.350 W*

Voltages & Currents (Note 4)

V_{CEO}	Collector to Emitter Voltage	14 V
I_C	Collector Current (Continuous)	200 mA

3

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage	14		V	I_C = 2.0 mA, I_B = 0
I_{CBO}	Collector Cutoff Current		100	nA	V_{CB} = 12 V, I_E = 0
I_{CES}	Collector Cutoff Current		100 5.0	nA μA	V_{CE} = 12 V, I_E = 0 V_{CE} = 12 V, I_E = 0, T_A = 125° C
h_{FE}	DC Current Gain (Note 5)	25 40 25	 200 		I_C = 1.0 mA, V_{CE} = 1.0 V I_C = 10 mA, V_{CE} = 1.0 V I_C = 50 mA, V_{CE} = 1.0 V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		250 400	mV mV	I_C = 10 mA, I_B = 1.0 mA I_C = 50 mA, I_B = 5.0 mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)	0.7	0.85 1.2	V V	I_C = 10 mA, I_B = 1.0 mA I_C = 50 mA, I_B = 5.0 mA
t_{on}	Turn On Time		12	ns	I_C = 10 mA, I_B = 3.0 mA
t_{off}	Turn Off Time		18	ns	I_C = 10 mA, I_{B1} = I_{B2} = 3.0 mA

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T132.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

FAIRCHILD

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FA Series

Matched Pair and Quad Assemblies Diodes

The FA Series are individual glass diodes featuring very tightly matched characteristics over broad temperature and current ranges.

- **ΔV_F...Down to 3 mV (MAX)**
- **ΔI_R...Down to 10 nA (MAX)**

PACKAGE

All Devices DO-7

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures	
Storage Temperature Range	−65°C to +200°C
Maximum Junction Operating Temperature	+175°C
Lead Temperature	+260°C
Power Dissipation (Note 2)	
Maximum Total Power Dissipation at 25°C Ambient Each Diode	250 mW
Linear Power Derating factor (from 25°C) Each Diode	1.67 mW/°C

Maximum Voltage and Currents

Basic Diode (See Specification below)		**FD1389**	**FD2389**	**FD3389**	**FD6389**
WIV	Working Inverse Voltage	75 V	150 V	125 V	50 V
I_O	Average Rectified Current	100 mA	100 mA	150 mA	200 mA
I_F	Continuous Forward Current	150 mA	150 mA	225 mA	300 mA
i_f	Recurrent Peak Forward Current	300 mA	300 mA	450 mA	600 mA
$i_{f(surge)}$	Peak Forward Surge Current				
	Pulse width = 1.0 s	1.0 A	1.0 A	1.0 A	1.0 A
	Pulse width = 1.0 μs	4.0 A	4.0 A	4.0 A	4.0 A

MATCHING CHARACTERISTICS (Apply over temperature range of −55°C to +100°C)

Basic Diode (See Specification below)	Forward Current Matching Range (Notes 4 & 6)	Reverse Current Match (ΔI_R Maximum) (Note 3)	Forward Voltage Match (ΔV_F Maximum)	Assembly Type Number	
				Pair	Quad
FD1389	10 μA to 1.0 mA		3.0 mV	FA2310U	FA4310U
FD1389	10 μA to 1.0 mA		10 mV	FA2311U	FA4311U
FD1389	1.0 mA to 10 mA		5.0 mV	FA2312U	FA4312U
FD1389	1.0 mA to 10 mA		15 mV	FA2313U	FA4313U

NOTES:

1. These are Limiting values above which life or satisfactory performance may be impaired
2. These are steady state Limits. The factory should be consulted on applications involving pulsed or low duty-cycle operation.
3. The Reverse Current Match (ΔI_R) is the difference in reverse current between the diode having the highest I_R and that having the lowest I_R in a given assembly. The reverse voltage (V_R) in the ΔI_R calculation can be any value up to 125 V. For example, the maximum ΔI_R for an FA2330IU at V_R of IO V is (2.0 + 0.064 x 10) nA or 2.64 nA.
4. The Forward Current Matching Ranges between 10 μA and 10 mA may be applied either as a dc current or a pulse current. Above 10 mA, however, the matching characteristics are guaranteed only for low duty cycle (≤1%) pulse current. Conditions of test are shown in the characteristic curve and test circuit section of this book
5. For product family characteristics curves for the basic diodes used in the assemblies, refer to the following parts of Section 4.
   FD1389 D4
   FD2389 D1
   FD3389 D2
   FD6389 D4

For test circuits, refer to Chapter 4, D18.

FA Series

Matched Pair and
Quad Assemblies Diodes

MATCHING CHARACTERISTICS (Apply over temperature range of −55°C to +100°C)

Basic Diode (See Specification below)	Forward Current Matching Range (Notes 4 & 6)	Reverse Current Match (ΔI_R Maximum) (Note 3)	Forward Voltage Match (ΔV_F Maximum)	Assembly Type Number	
				Pair	Quad
FD2389	10 µA to 1.0 mA		3.0 mV	FA2320U	FA4320U
FD2389	10 µA to 1.0 mA		10 mV	FA4321U	FA4321U
FD2389	1.0 mA to 10 mA		5.0 mV	FA2322U	FA4322U
FD2389	1.0 mA to 10 mA		15 mV	FA2323U	FA4323U
FD2389	10 mA to 100 mA		10 mV	FA2324U	FA4324U
FD2389	10 mA to 100 mA		20 mV	FA2325U	FA4325U
FD3389	10 µA to 1.0 mA	$(2.0 + 0.064\ V_R)$ nA	10 mV	FA2330U	FA4330U
FD3389	1.0 mA to 10 mA	$(2.0 + 0.064\ V_R)$ nA	15 mV	FA2331U	FA4331U
FD3389	10 mA to 100 mA	$(2.0 + 0.064\ V_R)$ nA	20 mV	FA2332U	FA4332U
FD3389	10 µA to 1.0 mA	$(4.0 + 0.128\ V_R)$ nA	10 mV	FA2333U	FA4333U
FD3389	1.0 mA to 10 mA	$(4.0 + 0.128\ V_R)$ nA	15 mV	FA2334U	FA4334U
FD3389	10 mA to 100 mA	$(4.0 + 0.128\ V_R)$ nA	20 mV	FA2335U	FA4335U
FD6389	10 mA to 100 mA		10 mV	FA2360U	FA4360U
FD6389	10 mA to 100 mA		20 mV	FA2361U	FA4361U

BASIC DIODE ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	FD1389		FD2389		FD3389		FD6389		UNITS	TEST CONDITIONS
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX		
BV	Breakdown Voltage	100								V	I_R = 5.0 µA
				200		150		75		V	I_R = 100 µA
I_R	Reverse Current		100		100		1.0		100	nA	V_R = WIV
			100		100		3.0		100	µA	V_R = WIV, T_A = 150°C
V_F	Forward Voltage				1.000		1.000		1.000	V	I_F = 200 mA
					0.925		0.930		0.920	V	I_F = 100 mA
					0.860		0.880		0.860	V	I_F = 50 mA
			1.000		0.790		0.840		0.790	V	I_F = 20 mA
			0.875		0.740		0.810		0.750	V	I_F = 10 mA
			0.800		0.700		0.770		0.710	V	I_F = 5.0 mA
			0.725		0.620		0.730		0.670	V	I_F = 2.0 mA
			0.670		0.610		0.710		0.630	V	I_F = 1.0 mA
C	Capacitance (Note 5)		2.0		5.0		6.0		3.0	pF	V_R = 0, f = 1 MHz
t_{rr}	Reverse Recovery Time		4.0							ns	$I_f = I_r$ = 10 mA Recover to 1.0 mA
					50					ns	$I_f = I_r$ = 30 mA Recover to 1.0 mA
									4.0	ns	$I_f = I_r$ = 200 mA Recover to 20 mA

FAIRCHILD
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FASO2618/FASO2718

High Conductance Ultra Fast Diode

- ΔV_F . . . **5 mV (Max) @ 5 mA**

ABSOLUTE MAXIMUM RATINGS (Notes 1 & 5)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

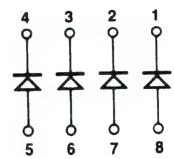
Power Dissipation (Note 2)

Total Dissipation	
per Junction at 25° C Ambient	300 mW*
per Package at 25° C Ambient	1.0 W
Linear Derating Factor	
Junction	2.4 mW/° C
Package	8.0 mW/° C

Voltages & Currents

W_{IV}	Working Inverse Voltage	
	FASA2618	75 V
	FASA2718	50 V
I_F	Continuous Forward Current	250 mA
i_f	Peak Forward Surge Current	
	Pulse Width = 1.0 s	1.0 A
	Pulse Width = 1.0 μs	2.0 A

Connection Diagram



PACKAGE

FASO2618	8-SOIC
FASO2718	8-SOIC

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 5)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
B_V	Breakdown Voltage (Note 5)				
	(FASO2718)	75		V	$I_R = 5.0\ \mu A$
	(FASO2618)	100		V	$I_R = 100\ \mu A$
I_R	Reverse Current (FASO2618)		5.0	μA	$V_R = 75$ V
			25	nA	$V_R = 20$ V
			50	μA	$V_R = 20$ V, $T_A = 150°$C
	(FASO2718)		100	nA	$V_R = 50$ V
			100	μA	$V_R = 50$ V, $T_A = 150°$C
V_F	Forward Voltage (Note 3)		1.0	V	$I_F = 10$ mA
t_{rr}	Reverse Recovery Time (Note 6)				
	(FASO2618)		5.0	ns	$I_f = I_r = 10$ mA, $I_{rr} = 1.0$ mA
	(FASO2718)		6.0	ns	$I_f = I_r = 10$ mA, $I_{rr} = 1.0$ mA

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. V_F is measured using an 8 ms pulse.
4. See test circuits (Note 6) for measurement of reverse current of an individual diode.
5. For product family characteristic curves, refer to Curve Set D-15.

* Package mounted on 99.5 alumina 12 mm x 18 mm 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 5)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
C	Capacitance (Note 6) (FASO2618) (FASO2718)		4.0 2.0	pF pF	$V_R = 0$ $V_R = 0$
ΔV_F	Forward Voltage Match (Note 6)		5.0	mV	$I_F = 5.0$ mA
t_{fr}	Forward Recovery Time (Note 6) (FASO2618)		20	ns	50 mA Peak Square wave, 0.1 μs Pulse Width, 5.0 kHz - 100 kHz
V_{FM}	Peak Forward Voltage (Note 6) (FASO2618)		3.0	V	$I_F = 100$ mA, $t_r \leqslant 10$ ns
RE	Rectification Efficiency	45		%	$V_f = 2.0$ V rms, f = 100 MHz
I_{SO}	Isolation Current		50	nA	$V_R = 50$ V

3

FAIRCHILD

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FDH300/FDLL300
FDH333/FDLL333

High Conductance Low Leakage Diodes

- **BV . . . 150 V (MIN) @ 100 µA**
- **I_R . . . 1.0 nA (MAX) @ 125 V (FDH300), 3.0 nA (MAX) @ 125 V (FDH333)**

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature Range	−65°C to +200°C
Maximum Junction Operating Temperature	+175°C
Lead Temperature	+260°C

Power Dissipation (Note 2)

Maximum Total Dissipation at 25°C Ambient	500 mW
Linear Derating Factor (from 25°C)	3.33 mW/°C

Maximum Voltages and Currents

WIV	Working Inverse Voltage	125 V
I_O	Average Rectified Current	200 mA
I_F	Forward Current Steady State	500 mA
i_f	Recurrent Peak Forward Current	600 mA
$i_{f(surge)}$	Peak Forward Surge Current	
	Pulse Width = 1.0 s	1.0 A
	Pulse Width = 1.0 µs	4.0 A

PACKAGES

FDH300	DO-35
FDH333	DO-35
FDLL300	LL-34
FDLL333	LL-34

If you need this device in the SOT package, an electical equivalent is available. See FDSO1500 family.

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	FDH300 MIN	FDH300 MAX	FDH333 MIN	FDH333 MAX	UNITS	TEST CONDITIONS
V_F	Forward Voltage			0.9	1.15	V	I_F = 300 mA
				0.88	1.08	V	I_F = 250 mA
			1.0	0.87	1.05	V	I_F = 200 mA
				0.86	0.97	V	I_F = 150 mA
			0.92	0.83	0.94	V	I_F = 100 mA
			0.88	0.80	0.89	V	I_F = 50 mA
			0.8			V	I_F = 10 mA
			0.75			V	I_F = 5.0 mA
			0.68			V	I_F = 1.0 mA
I_R	Reverse Current		1.0		3.0	nA	V_R = 125 V
			3.0			µA	V_R = 125 V, T_A = 150°C
					500	nA	V_R = 125 V, T_A = 100°C
C	Capacitance		6.0		6.0	pF	V_R = 0, f = 1MHz
BV	Breakdown Voltage	150		150		V	I_R = 100 µA

NOTES:
1. The maximum ratings are limiting values above which life or satisfactory performance may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. For family characteristic curves, refer to Chapter 4, D2.

FAIRCHILD
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FDH400/FDLL400
FDH444/FDLL444
High Voltage General Purpose Diodes

- **BV . . . 200 V (MIN) FDH400**
  . . . 150 V (MIN) FDH444
- **V_F . . . 1.1 V (MAX) @ 300 mA FDH400**
  @ 200 mA FDH444

PACKAGES

FDH400	DO-35
FDH444	DO-35
FDLL400	LL-34
FDLL444	LL-34

If you need this device in the SOT package, an electical equivalent is available. See FDSO1400 family.

3

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature Range	−65°C to +200°C
Max Junction Operating Temperature	+175°C
Lead Temperature	+260°C

Power Dissipation (Note 2)

Maximum Total Dissipation at 25°C Ambient	500 mW
Linear Derating Factor (from 25°C)	3.33 mW/°C

Maximum Voltage and Currents		**FDH400**	**FDH444**
WIV	Working Inverse Voltage	175 V	125 V
I_O	Average Rectified Current	200 mA	200 mA
I_F	Forward Current Steady State	500 mA	500 mA
i_f	Recurrent Peak Forward Current	600 mA	600 mA
$i_{f(surge)}$	Peak Forward Surge Current		
	Pulse width = 1.0 s	1.0 A	1.0 A
	Pulse width = 1.0 μs	4.0 A	4.0 A

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	FDH400		FDH444		UNITS	TEST CONDITIONS
		MIN	MAX	MIN	MAX		
VF	Forward Voltage		1.1 1.0		1.2 1.1	V V	I_F = 300 mA I_F = 200 mA
BV	Breakdown Voltage	200		150		V	I_R = 100 μA
I_R	Reverse Current		100 100 		 50 100	nA nA μA μA	V_R = 150 V V_R = 100 V V_R = 150 V, T_A = 150°C V_R = 100 V, T_A = 150°C
C	Capacitance		2.0		2.5	pF	V_R = 0, f = 1.0 MHz
t_{rr}	Reverse Recovery Time		50		60	ns	I_f = 30 mA, I_r = 30 mA R_L = 100 Ω, I_{rr} = 3.0 mA

NOTES:
1. The maximum ratings are limiting values above which life or satisfactory performance may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. For product family characteristic curves, refer to Chapter 4, D1.

FAIRCHILD

A Schlumberger Company

FDH600/FDLL600
FDH666/FDLL666

Ultra Fast Diodes

- **C . . . 2.5 pF (MAX) FDH600, 3.5 pF (MAX) FDH666**
- **V_F . . . 1.0 V (MAX) @ 100 mA (FDH666)**
  . . . 1.0 V (MAX) @ 200 mA (FDH600)
- **t_{rr} . . . 4.0 ns (MAX) @ $I_f = I_r$ = 10 mA**

PACKAGES

FDH600	DO-35
FDH666	DO-35
FDLL600	LL-34
FDLL666	LL-34

If you need this device in the SOT package, an electical equivalent is available. See FDSO1200 family.

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature Range	−65°C to +200°C
Maximum Junction Operating Temperature	+175°C
Lead Temperature	+260°C

Power Dissipation (Note 2)

Maximum Total Dissipation at 25°C Ambient	500 mW
Linear Derating Factor (from 25°C)	3.33 mW/°C

Maximum Voltage and Currents

		FDH 600	FDH 666
WIV	Working Inverse Voltage	50 V	25 V
I_O	Average Rectified Current	200 mA	200 mA
I_F	Continuous Forward Current	500 mA	500 mA
i_f	Recurrent Peak Forward Current	600 mA	600 mA
$i_{f(surge)}$	Peak Forward Surge Current		
	Pulse Width = 1.0 s	1.0 A	1.0 A
	Pulse Width = 1.0 μs	4.0 A	4.0 A

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	FDH600		FDH666		UNITS	TEST CONDITIONS
		MIN	MAX	MIN	MAX		
V_F	Forward Voltage		1.0			V	I_F = 200 mA
			0.92		1.0	V	I_F = 100 mA
			0.86		0.86	V	I_F = 50 mA
			0.79		0.79	V	I_F = 10 mA
			0.65		0.65	V	I_F = 1.0 mA
I_R	Reverse Current		0.1			μA	V_R = 50 V
					0.1	μA	V_R = 25 V
			100			μA	V_R = 50 V, T_A = 150°C
					100	μA	V_R = 25 V, T_A = 150°C
BV	Breakdown Voltage	75		40		V	I_R = 5.0 μA
t_{rr}	Reverse Recovery Time (Note 3)		4.0		4.0	ns	$I_f = I_r$ = 10 mA, R_L = 100 Ω
			6.0		6.0	ns	$I_f = I_r$ = 200 mA, R_L = 100 Ω
C	Capacitance		2.5		3.5	pF	V_R = 0, f = 1.0 MHz

NOTES:
1. The maximum ratings are limiting values above which life or satisfactory performance may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty-cycle operation.
3. Recovery to 0.1 I_R.
4. For product family characteristic curves, refer to Chapter 4, D4.

FAIRCHILD

A Schlumberger Company

FD700/FDLL700
FD777/FDLL777
Ultra Fast Diodes

- C . . . 1.0 pF (MAX) @ V_R = 0, f = 1.0 MHz (FD 700)
- t_{rr} . . . 700 ps (MAX) @ $I_f = I_r$ = 10 mA, R_L = 100 Ω (FD 700)
- CONTROLLED FORWARD CONDUCTANCE

PACKAGES

FD700	DO-7
FD777	DO-7
FDLL700	LL-34
FDLL777	LL-34

If you need this device in the SOT package, an electical equivalent is available. See FDSO1700 family.

ABSOLUTE MAXIMUM RATINGS (Note 1)

		FD700	FD777
Temperatures			
Storage Temperature Range		−65°C to +200°C	−65°C to +200°C
Max Junction Operating Temperature		+175°C	+175°C
Lead Temperature		+260°C	+260°C
Power Dissipation			
Maximum Total Dissipation at 25°C Ambient		250 mW	250 mW
Linear Derating Factor (from 25°C)		1.67 mW/°C	1.67 mW/°C
Maximum Voltages and Currents			
WIV	Working Inverse Voltage	20 V	8.0 V
I_O	Average Rectified Current	50 mA	50 mA
I_F	Forward Current Steady State dc	150 mA	150 mA
i_f	Recurrent Peak Forward Current	150 mA	150 mA
$i_{f\,(surge)}$	Peak Forward Surge Current Pulse Width = 1.0 s	250 mA	250 mA

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	FD700		FD777		UNITS	TEST CONDITIONS
		MIN	MAX	MIN	MAX		
V_F	Forward Voltage	0.89	1.10	0.89	1.35	V	I_F = 50 mA
		0.81	0.95	0.81	1.00	V	I_F = 20 mA
		0.76	0.88	0.76	0.94	V	I_F = 10 mA
		0.64	0.74	0.64	0.79	V	I_F = 1.0 mA
		0.52	0.61	0.52	0.64	V	I_F = 0.1 mA
		0.42	0.50	0.42	0.53	V	I_F = 0.01 mA
BV	Breakdown Voltage	30		15		V	I_R = 5.0 μA
I_R	Reverse Current		50			nA	V_R = 20 V
					100	nA	V_R = 8.0 V
			50			μA	V_R = 20 V, T_A = 150°C
					50	μA	V_R = 8.0 V, T_A = 150°C
τ	Minority Carrier Lifetime		450		450	ps	(see Note 2)
t_{rr}	Reverse Recovery Time (Note 3)		700		750	ps	$I_f = I_r$ = 10 mA, R_L = 100 Ω
C	Capacitance		1.0		1.3	pF	V_R = 0, f = 1.0 MHz

NOTES:
1. The maximum ratings are limiting values above which life or satisfactory performance may be impaired.
2. Measured as suggested by S. M. Krakauer, IRE Proceedings, Volume 60, July 1962, pp. 1674 - 1675.
3. Recovery to 0.1 I_R.
4. For product family characteristic curves, refer to Chapter 4, D3.

FAIRCHILD

A Schlumberger Company

FDH900/FDLL900
FDH999/FDLL999

High Speed Switching Diodes

- BV . . . 45V (FDH900), 35 V (FDH999)
- t_{rr} . . . 4.0 ns (FDH900), 5.0 ns (FDH999)

PACKAGES

FDH900	DO-35
FDH999	DO-35
FDLL900	LL-34
FDLL999	LL-34

If you need this device in the SOT package, an electical equivalent is available. See FDSO1200 family.

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature Range	−65°C to +200°C
Max. Junction Operating Temperature	+175°C
Lead Temperature	+260°C

Power Dissipation (Note 2)

Maximum Total Dissipation at 25°C Ambient	500 mW
Linear Derating Factor (From 25°C)	3.3 mW/°C.

Maximum Voltage and Currents

WIV	Working Inverse Voltage	FDH900	40 V
		FDH999	25 V
I_O	Average Rectified Current		200 mA
I_F	Continuous Forward Current		500 mA
i_f	Recurrent Peak Forward Current		600 mA
$i_{f(surge)}$	Peak Forward Surge Current		
	Pulse Width = 1.0 s		1.0 A
	Pulse Width = 1.0 μs		4.0 A

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	FDH900		FDH999		UNITS	TEST CONDITIONS
		MIN	MAX	MIN	MAX		
BV	Breakdown Voltage	45		35		V	$I_R = 5.0\ \mu A$
I_R	Reverse Current				1.0	μA	$V_R = 25$ V
			500			nA	$V_R = 40$ V
V_F	Forward Voltage				1.0	V	$I_F = 10$ mA
			1.0			V	$I_F = 100$ mA
C	Capacitance		3.0		5.0	pF	$V_R = 0$, f = 1.0 MHz
t_{rr}	Reverse Recovery Time		4.0		5.0	ns	$I_f = 10$ mA, $I_r = 10$ mA, $R_L = 100\ \Omega$, $I_{rr} = 1.0$ mA

NOTES:
1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty-cycle operation.
3. For product family characteristic curves, refer to Chapter 4, D4.

FAIRCHILD

A Schlumberger Company

FDH1000/FDLL1000

High Conductance Switching Diodes

- V_F . . . 1 V (max) @ 500 mA
- Q_S . . . 100 pC (max)

PACKAGES

FDH1000	DO-35
FDLL1000	LL-34

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature Range	−65°C to +200°C
Maximum Junction Operating Temperature	+175°C
Lead Temperature	+260°C

Power Dissipation (Note 2)

Maximum Total Power Dissipation at 25°C Ambient	500 mW
Linear Power Derating Factor	3.33 mW/°C

Maximum Voltage and Currents

WIV	Working Inverse Voltage	50 V
I_O	Average Rectified Current	200 mA
I_F	Continuous Forward Current	500 mA
i_f	Peak Repetitive Forward Current	600 mA
$i_{f(surge)}$	Peak Forward Surge Current	
	Pulse Width = 1 s	1.0 A
	Pulse Width = 1 μs	4.0 A

3

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
V_f	Forward Voltage		1.0	V	I_F = 500 mA
I_R	Reverse Current		5.0 50 50	μA nA μA	V_R = 50 V V_R = 20 V V_R = 20 V, T_A = 125°C
BV	Breakdown Voltage	75		V	I_R = 100 μA
C	Capacitance		5.0	pF	V_R = 0. f = 1.0 MHz
Q_S	Stored Charge		100	pC	I_f = 10 mA, V_R = 10 V

NOTES:
1. Maximum ratings are limiting values above which life or satisfactory performance may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty-cycle operation.
3. For family characteristic curves, refer to Chapter 4, D4.

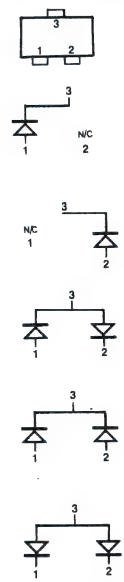
FAIRCHILD
A Schlumberger Company

FDSO1201 - 1205

High Conductance Ultra Fast Diode

- **B_V . . . 200 V (Min)**
- **I_r . . . 1.0 ns (Max) @ 125 V**

Connection Diagram



1201

1202

1203

1204

1205

PACKAGE

FDSO1201	TO-236AA/AB
FDSO1202	TO-236AA/AB
FDSO1203	TO-236AA/AB
FDSO1204	TO-236AA/AB
FDSO1205	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Device Dissipation at T_A = 25° C	0.350 mW

Voltages & Currents (Note 4)

W_{IV}	Working Inverse Voltage	150 V
I_O	Average Rectified Current	200 mA
I_f	DC Forward Current	300 mA
i_f	Recurrent Peak Forward Current	400 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 5)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
B_V	Breakdown Voltage	100		V	$I_R = 100\ \mu A$
I_R	Reverse Current		25 50 5.0	nA nA nA	$V_R = 20$ V $V_R = 50$ V $V_R = 50$ V, $T_J = 150°$ C
V_F	Forward Voltage	0.55 0.66 0.82 0.87	0.60 0.74 0.92 1.0 1.1	V V V V V	$I_F = 1.0$ mA $I_F = 10$ mA $I_F = 100$ mA $I_F = 200$ mA $I_F = 300$ mA
t_{rr}	Reverse Recovery Time		4.0	ns	$I_F = I_R = 10$ mA, $R_L = 100\ \Omega$, $I_{RR} = 1.0$ mA
C	Capacitance		2.0	pF	$V_R = 0$, f = 1.0 MHz

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. For product family characteristic curves, refer to Curve Set D-1.

FAIRCHILD
A Schlumberger Company

FDSO1401 - 1405

High Voltage General Purpose Diode

- **P_D . . . 350 mW @ T_A = 25° C**
- **B_V . . . 200 V (Min)**
- **V_F . . . 1.1 V (Max) @ 300 mA**

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	150° C
Operating Junction Temperature	150° C

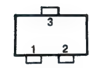
Power Dissipation (Notes 2 & 3)

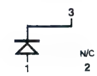
Total Device Dissipation at T_A = 25° C	0.350 mW

Voltages & Currents

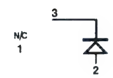
W_{IV}	Working Inverse Voltage	200 V
I_O	Average Rectified Current	200 mA
I_f	DC Forward Current	300 mA
i_f	Recurrent Peak Forward Current	400 mA

Connection Diagram





1401



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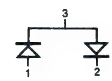

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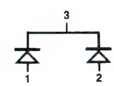
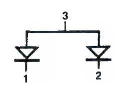


1404



1405

PACKAGE	
FDSO1401	TO-236AA/AB
FDSO1402	TO-236AA/AB
FDSO1403	TO-236AA/AB
FDSO1404	TO-236AA/AB
FDSO1405	TO-236AA/AB

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 4)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
B_V	Breakdown Voltage	200		V	I_R = 100 μA
I_R	Reverse Voltage Leakage Current		40 100	nA nA	V_R = 120 V V_R = 175 V
V_F	Forward Voltage	 0.76 	0.80 0.92 1.0 1.1	V V V V	I_F = 10 mA I_F = 50 mA I_F = 200 mA I_F = 300 mA
C	Capacitance		2.0	pF	V_R = 0, f = 1.0 MHz
t_{rr}	Reverse Recovery Time		50	ns	I_F = 30 mA, I_{rr} = 1.0 mA, R_L = 100 Ω

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. For product family characteristic curves, refer to Curve Set D-2.

FAIRCHILD

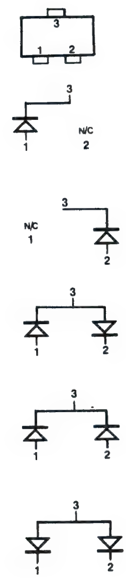
A Schlumberger Company

FDSO1501 - 1505

High Conductance Low Leakage Diode

- P_D . . . 350 mW @ T_A = 25° C
- B_V . . . 200 V (Min)
- I_R . . . 1.0 nA (Max) @ 125 V

Connection Diagram



1501

1502

1503

1504

1505

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Device Dissipation at T_A = 25° C	0.350 mW

Voltages & Currents

W_{IV}	Working Inverse Voltage	150 V
I_O	Average Rectified Current	200 mA
I_f	DC Forward Current	300 mA
i_f	Recurrent Peak Forward Current	400 mA

PACKAGE

FDSO1501	TO-236AA/AB
FDSO1502	TO-236AA/AB
FDSO1503	TO-236AA/AB
FDSO1504	TO-236AA/AB
FDSO1505	TO-236AA/AB

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 4)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
B_V	Breakdown Voltage	200		V	$I_R = 5\ \mu A$
I_R	Reverse Voltage Leakage Current		1.0	nA	V_R = 125 V
			10	nA	V_R = 180 V
			5.0	μA	V_R = 180 V, T_A = 150° C
			3.0	μA	V_R = 125 V, T_A = 150° C
V_F	Forward Voltage	0.60	0.68	V	I_F = 1.0 mA
		0.69	0.80	mV	I_F = 10 mA
		0.80	0.88	mV	I_F = 50 mA
		0.83	0.92	mV	I_F = 100 mA
		0.87	1.0	mV	I_F = 200 mA
		0.90	1.15	mV	I_F = 300 mA
C_T	Diode Capacitance		4.0	pF	V_R = 0, f = 1.0 MHz

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. For product family characteristic curves, refer to Curve Set D-2.

FDSO1701 - 1705

Picosecond Computer Diode

3

- P_D ... 350 mW @ T_A = 25° C
- C_T ... 1.0 pf (Max) @ V_R = 0, f = 1.0 MHz
- t_{rr} ... 700 ps (Max) @ I_f = I_r = 10 mA, RL = 100 Ω

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	150° C
Operating Junction Temperature	150° C

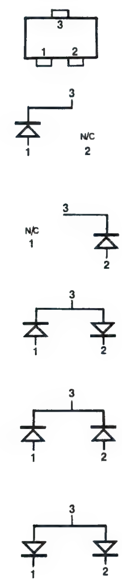
Power Dissipation (Notes 2 & 3)

Total Device Dissipation at T_A = 25° C	0.350 mW

Voltages & Currents

W_{IV}	Working Inverse Voltage	20 V
I_O	Average Rectified Current	50 mA
I_f	DC Forward Current	150 mA
i_f	Recurrent Peak Forward Current	150 mA

Connection Diagram



1701

1702

1703

1704

1705

PACKAGE

FDSO1701	TO-236AA/AB
FDSO1702	TO-236AA/AB
FDSO1703	TO-236AA/AB
FDSO1704	TO-236AA/AB
FDSO1705	TO-236AA/AB

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 4)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
B_V	Breakdown Voltage	30		V	I_R = 5.0 μA
I_R	Reverse Voltage Leakage Current	50		nA	V_R = 20 V
V_F	Forward Voltage	0.42	0.50	V	I_F = 10 μA
		0.52	0.61	V	I_F = 100 μA
		0.64	0.74	V	I_F = 1.0 mA
		0.76	0.88	V	I_F = 10 mA
		0.81	0.95	V	I_F = 20 mA
		0.89	1.1	V	I_F = 50 mA
C_T	Diode Capacitance		1.0	pF	V_R = 0, f = 1.0 MHz
t_{rr}	Reverse Recovery Time		700	ps	I_F = I_R = 10 mA, I_{RR} = 1.0 mA, R_L = 100 Ω

NOTES:
1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. For product family characteristic curves, refer to Curve Set D-3.

FAIRCHILD

A Schlumberger Company

FJT1100/FJT1101

Ultra Low Leakage Diodes

- **I_R . . . 1.0 pA (MAX) @ 5V (FJT1100)**
- **BV . . . 20 V (MIN) (FJT1100)**

PACKAGES

FJT1100	DO-7
FJT1101	DO-7

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperature			
Storage Temperature Range			−55°C to +200°C
Maximum Junction Operating Temperature			+175°C
Lead Temperature			+260°C
Power Dissipation (Note 2)			
Maximum Total Power Dissipation at 25°C Ambient			250 mW
Linear Power Derating factor (from 25°C)			1.67 mW/°C
Maximum Voltage and Current			
WIV	Working Inverse Voltage	FJT1100	25 V
		FJT1101	15 V
I_f	Continuous Forward Current		150 mA

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC		MIN	MAX	UNITS	TEST CONDITIONS
BV	Breakdown Voltage	FJT1100	30		V	I_R = 5.0 μA
		FJT1101	20		V	I_R = 5.0 μA
I_R	Reverse Current	FJT1100		1.0	pA	V_R = 5.0 V
				10	pA	V_R = 15V
		FJT1101		5.0	pA	V_R = 5.0V
				15	pA	V_R = 15V
V_F	Forward Voltage	FJT1100		1.05	V	I_F ≐ 50 mA
		FJT1101		1.10	V	I_F = 50 mA
C	Capacitance	FJT1100		1.5	pF	V_R = 0, f = 1MHz
		FJT1101		1.8	pF	V_R = 0, f = 1MHz

NOTES:
1. These are limiting values above which the serviceability of the diode may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed of low duty-cycle operation.
3. For product family characteristic curves and applications information, refer to Chapter 4, D6.

FAIRCHILD

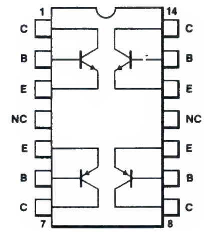
A Schlumberger Company

FPQ2222/FQSO2222

NPN Quad General Purpose Amplifier

- **Compact Popular IC Package . . . 4 Transistors per Package; 14 Pin Plastic DIP Compatible with Automatic Insertion Equipment (FPQ2222)**
- **High Breakdown Voltage . . . 40 V $V_{CEO(sus)}$**
- **DC Current Gain Specified . . . 10 to 300 mA**
- **Similar to 2N2222 Series**
- **Gull Wing Surface Mount Package (FQSO)**

CONNECTION DIAGRAM



CD3

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	FPQ	FQSO
25° C Ambient Temperature (Each Transistor)	0.65 W	
25° C Ambient Temperature	2.0 W	1.0 W

Voltages & Currents (Note 4)

V_{CEO}	Collector to Emitter Voltage	40 V
V_{CBO}	Collector to Base Voltage	60 V
V_{EBO}	Emitter to Base Voltage	5.0 V
I_C	Collector Current	600 mA

PACKAGE

FPQ2222	TO-116
FQSO2222	14SOIC

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 5)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CBO}	Collector to Base Breakdown Voltage	60		V	$I_C = 10\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0		V	$I_E = 10\ \mu A$, $I_C = 0$
I_{EBO}	Emitter Cutoff Current		50	nA	$V_{EB} = 3.0$ V, $I_C = 0$
I_{CBO}	Collector Cutoff Current		50	nA	$V_{CB} = 50$ V, $I_E = 0$
h_{FE}	DC Pulse Current Gain (Note 4)	75 100 30			$I_C = 10$ mA, $V_{CE} = 10$ V $I_C = 150$ mA, $V_{CE} = 10$ V $I_C = 300$ mA, $V_{CE} = 10$ V
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage	40		V	$I_C = 10$ mA, $I_B = 0$
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Pulsed) (Note 4)		1.3 2.6	V V	$I_C = 150$ mA, $I_B = 15$ mA $I_C = 300$ mA, $I_B = 30$ mA
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 4)		0.4 1.6	V V	$I_C = 150$ mA, $I_B = 15$ mA $I_C = 300$ mA, $I_B = 30$ mA
C_{ob}	Output Capacitance		8.0	pF	$V_{CB} = 10$ V, f = 100 kHz
C_{ib}	Input Capacitance		30	pF	$V_{BE} = 0.5$ V, f = 100 kHz
f_T	Current Gain Bandwidth Product	200		MHz	$I_C = 20$ mA, $V_{CE} = -20$ V, f = 100 MHz

NOTES:

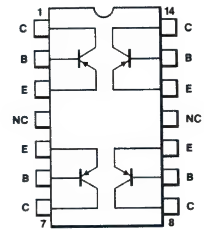
1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and junction-to-ambient thermal resistance of 62.5° C/W (derating factor of 16 mW/° C). FQSO power dissipation data is only an estimate, and may be subject to change without notice.
4. Pulse conditions: length = 300 μs; duty cycle = 1%.
5. For product family characteristic curves, refer to Curve Set T145.

FPQ2907/FQSO2907

PNP Quad General Purpose Amplifier

- **High Breakdown Voltage . . . 40 V $V_{CEO(sus)}$**
- **DC Current Gain Specified . . . 10 to 300 mA**
- **Similar to 2N2907 Series**

Connection Diagram



PACKAGE

FPQ2907	TO-116
FQSO2907	14-SOIC

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures	
Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C
Power Dissipation (Notes 2 & 3)	
Total Dissipation at	
25° C Ambient Temperature (Each Transistor)	0.65 W
25° C Ambient Temperature	2.0 W
Voltages & Currents (Notes 4 & 5)	
V_{CEO} Collector to Emitter Voltage	−40 V
V_{CBO} Collector to Base Voltage	−60 V
V_{EBO} Emitter to Base Voltage	−5.0 V
I_C Collector Current	600 mA

For SOIC power dissipation, consult factory.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CBO}	Collector to Base Breakdown Voltage	−60		V	$I_C = 10\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	−5.0		V	$I_E = 10\ \mu A$, $I_C = 0$
I_{EBO}	Emitter Cutoff Current		50	nA	$V_{EB} = 3.0$ V, $I_C = 0$
I_{CBO}	Collector Cutoff Current		50	nA	$V_{CB} = -50$ V, $I_E = 0$
h_{FE}	DC Pulse Current Gain	75 100 50			$I_C = 10$ mA, $V_{CE} = -10$ V $I_C = 150$ mA, $V_{CE} = -10$ V $I_C = 300$ mA, $V_{CE} = -10$ V
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage	−40		V	$I_C = 10$ mA, $I_B = 0$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 4)		−0.4 −1.6	V V	$I_C = 150$ mA, $I_B = 15$ mA $I_C = 300$ mA, $I_B = 30$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Pulsed) (Note 4)		−1.3 2.6	V V	$I_C = 150$ mA, $I_B = 15$ mA $I_C = 300$ mA, $I_B = 30$ mA
C_{ob}	Output Capacitance		8.0	pF	$V_{CB} = -10$ V, f = 100 kHz
C_{ib}	Input Capacitance		30	pF	$V_{BE} = 0.5$ V, f = 100 kHz
f_T	Current Gain Bandwidth Product	200		MHz	$I_C = 20$ mA, $V_{CE} = -20$ V, f = 100 MHz

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and junction-to-ambient thermal resistance of 62.5° C/W (derating factor of 16 mW/° C).
4. Pulse conditions: length = 300 μs; duty cycle = 1%.
5. For product family characteristic curves, refer to Curve Set T212.

FAIRCHILD

A Schlumberger Company

FPQ3724/FPQ3725
FQSO3724/FQSO3725

NPN Quad Core Driver

- $V_{CEO(sus)}$ . . . **50 V (Min) (FPQ3725)**
- t_{on} . . . **25 ns (Typ)**
- t_{off} . . . **45 ns (Typ)**
- **High Current . . . 500 mA**

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

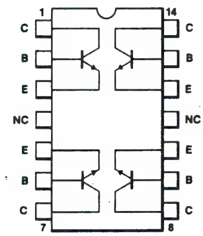
Storage Temperature	−65° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at 25° C Ambient Temperature	2.0 W
25° C Ambient Temperature (Each Transistor)	0.65 W

For SOIC power dissipation, consult factory.

Connection Diagram



PACKAGES

FPQ3724	TO-116
FPQ3725	TO-116
FQSO3724	14-SOIC
FQSO3725	14-SOIC

3

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 5)

SYMBOL	CHARACTERISTIC	3724 MIN	3724 MAX	3725 MIN	3725 MAX	UNITS	TEST CONDITIONS
BV_{CES}	Collector to Emitter Breakdown Voltage	70		80		V	$I_C = 10\ \mu A$, $I_B = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	70		80		V	$I_C = 10\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	6.0		6.0		V	$I_E = 10\ \mu A$, $I_C = 0$
I_{CBO}	Collector Cutoff Current		1.7 120		1.7 120	μA μA	$V_{CB} = 40$ V, $I_E = 0$ $V_{CB} = 40$ V, $I_E = 0$, $T_A = 100°$ C
h_{FE}	DC Pulse Current Gain (Note 4)	50 30		50 20			$I_C = 100$ mA, $V_{CE} = 1.0$ V $I_C = 500$ mA, $V_{CE} = 1.0$ V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 4)		0.5 0.5 0.6		0.5 0.5 0.6	V V V	$I_C = 500$ mA, $I_B = 50$ mA $I_C = 500$ mA, $I_B = 50$ mA, $T_A = -55°$ C $I_C = 500$ mA, $I_B = 50$ mA, $T_A = 100°$ C

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and junction-to-ambient thermal resistance of 62.5° C/W (derating factor of 16 mW/° C) for FPQ3724 and FPQ3725.
4. Pulse conditions: length = 300 μs; duty cycle = 1%.
5. For product family characteristic curves, refer to Curve Set T139.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 5)

SYMBOL	CHARACTERISTIC	3724 MIN	3724 MAX	3725 MIN	3725 MAX	UNITS	TEST CONDITIONS
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 4)		1.2		1.2	V	$I_C = 500$ mA, $I_B = 50$ mA
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Note 4)	40		50		V	$I_C = 10$ mA, $I_B = 0$
C_{cb}	Collector to Base Capacitance		12		12	pF	$V_{CB} = 10$ V, $I_E = 0$
C_{eb}	Emitter to Base Input Capacitance		60		60	pF	$V_{BE} = 0.5$ V, $I_C = 0$
h_{fe}	High Frequency Current Gain	2.0		2.0			$I_C = 50$ mA, $V_{CE} = 10$ V, f = 100 MHz
t_s	Storage Time (test circuit no. 265)		50		50	ns	$I_C = 500$ mA, $I_{B1} = I_{B2} = 50$ mA
t_{on}	Turn On Time (test circuit no. 265)		35		35	ns	$I_C = 500$ mA, $I_{B1} = 50$ mA
t_{off}	Turn Off Time (test circuit no. 265)		60		60	ns	$I_C = 500$ mA, $I_{B1} = I_{B2} = 50$ mA

FAIRCHILD

A Schlumberger Company

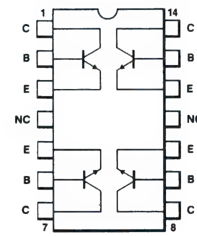
FPQ3904/MPQ3904 FQSO3904

Quad NPN Switching Transistor

The 3904 features four NPN silicon transistors in one package. The transistors are similar to 2N3904.

- **Fast Switching**
- **JEDEC (TO-116) 14-Pin Plastic DIP (FPQ/MPQ)**
- **Auto-Insertion Compatible**
- **Gull wing surface mount package (FQSO)**

Connection Diagram



PACKAGE

FPQ3904	TO-116
MPQ3904	TO-116
FQSO3904	14 SOIC

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C
Lead Temperature (Soldering, 10 s)	275° C

Power Dissipation (Notes 2, 3 & 5)

	FPQ/MPQ	FQSO*
Total Dissipation at T_A = 25° C	900 mW	1.0 W
Derate above 25° C	7.2 mW/° C	8.0 mW/° C
Power Dissipation at T_A = 25° C Each Transistor	500 mW	300 mW
Derate above 25° C	4.0 mW/° C	2.4 mW/° C

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage	40 V
V_{CBO}	Collector to Base Voltage	60 V
V_{EBO}	Emitter to Base Voltage	6.0 V
I_C	Collector Current	200 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 5)

SYMBOL	CHARACTERISTIC	FPQ/FQSO MIN	TYP	MAX	UNITS	TEST CONDITIONS
BV_{CBO}	Collector to Base Breakdown Voltage	60			V	$I_C = 10\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	6.0			V	$I_E = 10\ \mu A$, $I_C = 0$
I_{CBO}	Collector Cutoff Current			50	nA	$V_{CB} = 40$ V, $I_E = 0$
I_{EBO}	Emitter Cutoff Current			50	nA	$V_{EB} = 3.0$ V, $I_C = 0$

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and junction-to-ambient thermal resistance of 139° C/W (derating factor of 7.2 mW/° C).
4. Pulse conditions: length = 300 μs; duty cycle = 1%.
5. FQSO power dissipation data is only an estimate, and may be subject to change without notice.
6. For product family characteristic curves, refer to Curve Set T215.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

3

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 5)

SYMBOL	CHARACTERISTIC	FPQ/FQSO MIN	TYP	MAX	UNITS	TEST CONDITIONS
h_{FE}	DC Current Gain (Note 4)	40 70 100 50		 300 		I_C = 0.1 mA, V_{CE} = 1.0 V I_C = 1.0 mA, V_{CE} = 1.0 V I_C = 10 mA, V_{CE} = 1.0 V I_C = 50 mA, V_{CE} = 1.0 V
$V_{CE(sat)}$	Pulsed Collector Saturation Voltage (Note 4)			0.2 0.3	V V	I_C = 10 mA, I_B = 1.0 mA I_C = 50 mA, I_B = 5.0 mA
$V_{BE(sat)}$	Pulsed Base Saturation Voltage (Note 4)	0.65		0.85 0.95	V V	I_C = 10 mA, I_B = 1.0 mA I_C = 50 mA, I_B = 5.0 mA
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage	40			V	I_C = 1.0 mA, I_B = 0
f_T	Current Gain Bandwidth Product	250			MHz	I_C = 10 mA, V_{CE} = 20 V, f = 100 MHz
C_{ob}	Output Capacitance			4.0	pF	V_{CB} = 5.0 V, f = 1.0 MHz
C_{ib}	Input Capacitance			8.0	pF	V_{EB} = 0.5 V, f = 1.0 MHz
t_{on}	Turn-On Time		30		ns	I_C = 10 mA, I_{B1} = I_{B2} 1.0 mA
t_{off}	Turn-Off Time		125		ns	I_C = 10 mA, I_{B1} = I_{B2} 1.0 mA

SYMBOL	CHARACTERISTIC	MPQ MIN	TYP	MAX	UNITS	TEST CONDITIONS
BV_{CBO}	Collector to Base Breakdown Voltage	60			V	I_C = 10 μA, I_E = 0
BV_{EBO}	Emitter to Base Breakdown Voltage	6.0			V	I_E = 10 μA, I_C = 0
I_{CBO}	Collector Cutoff Current			50	nA	V_{CB} = 40 V, I_E = 0
I_{EBO}	Emitter Cutoff Current			50	nA	V_{EB} = 3.0 V, I_C = 0
h_{FE}	DC Current Gain (Note 4)	30 50 75				I_C = 0.1 mA, V_{CE} = 1.0 V I_C = 1.0 mA, V_{CE} = 1.0 V I_C = 10 mA, V_{CE} = 1.0 V
$V_{CE(sat)}$	Pulsed Collector Saturation			0.2	V	I_C = 10 mA, I_B = 1.0 mA
$V_{BE(sat)}$	Pulsed Base Saturation Voltage (Note 4)			0.85	V	I_C = 10 mA, I_B = 1.0 mA
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage	40			V	I_C = 1.0 mA, I_B = 0
f_T	Current Gain Bandwidth Product	250			MHz	I_C = 10 mA, V_{CE} = 20 V, f = 100 MHz
C_{ob}	Output Capacitance			4.0	pF	V_{CB} = 5.0 V, f = 1.0 MHz
C_{ib}	Input Capacitance			8.0	pF	V_{EB} = 0.5 V, f = 1.0 MHz
t_{on}	Turn-On Time		30		ns	I_C = 10 mA, I_{B1} = I_{B2} 1.0 mA
t_{off}	Turn-Off Time		125		ns	I_C = 10 mA, I_{B1} = I_{B2} 1.0 mA

FAIRCHILD

A Schlumberger Company

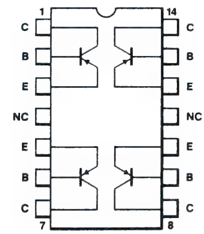
FPQ3906/MPQ3906 FQSO3906

Quad PNP Switching Transistor

The 3906 features four PNP silicon transistors in one package. The transistors are similar to 2N3906.

- **Fast Switching**
- **JEDEC (TO-116) 14-Pin Plastic DIP (FPQ/MPQ)**
- **Auto-Insertion Compatible**
- **Gull wing surface mount package (FQSO)**

Connection Diagram



PACKAGE	
FPQ3906	TO-116
MPQ3906	TO-116
FQSO3906	14 SOIC

3

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	$-55°$ C to 150° C
Operating Junction Temperature	150° C
Lead Temperature (Soldering, 10 s)	275° C

Power Dissipation (Notes 2, 3 & 5)

Total Dissipation at	**FPQ/MPQ**	**FQSO***
T_A = 25° C	900 mW	1.0 W
Derate above 25° C	7.2 mW/° C	8.0 mW/° C
Power Dissipation at		
T_A = 25° C Each Transistor	500 mW	300 mW
Derate above 25° C	4.0 mW/° C	2.4 mW/° C

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage	40 V
V_{CBO}	Collector to Base Voltage	40 V
V_{EBO}	Emitter to Base Voltage	5.0 V
I_C	Collector Current	200 mA

Electrical Characteristics (25° C Ambient Temperature unless otherwise noted) (Note 5)

SYMBOL	CHARACTERISTIC	FPQ/FQSO MIN	TYP	MAX	UNITS	TEST CONDITIONS
BV_{CBO}	Collector to Base Breakdown Voltage	40			V	$I_C = 10\ \mu A,\ I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0			V	$I_E = 10\ \mu A,\ I_C = 0$
I_{CBO}	Collector Cutoff Current			20	nA	$V_{CB} = 30$ V, $I_E = 0$
I_{EBO}	Emitter Cutoff Current			50	nA	$V_{EB} = 4.0$ V, $I_C = 0$

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and junction-to-ambient thermal resistance of 139° C/W (derating factor of 7.2 mW/° C).
4. Pulse conditions: length = 300 μs; duty cycle = 1%.
5. FQSO power dissipation data is only an estimate, and may be subject to change without notice.
6. For product family characteristic curves, refer to Curve Set T215.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

Electrical Characteristics (25° C Ambient Temperature unless otherwise noted) (Note 5)

SYMBOL	CHARACTERISTIC	FPQ/FQSO MIN	TYP	MAX	UNITS	TEST CONDITIONS
h_{FE}	DC Current Gain (Note 4)	40 70 100 50		 300		$I_C = 0.1$ mA, $V_{CE} = 1.0$ V $I_C = 1.0$ mA, $V_{CE} = 1.0$ V $I_C = 10$ mA, $V_{CE} = 1.0$ V $I_C = 50$ mA, $V_{CE} = 1.0$ V
$V_{CE(sat)}$	Pulsed Collector Saturation Voltage (Note 4)			0.25 0.4	V V	$I_C = 10$ mA, $I_B = 1.0$ mA $I_C = 50$ mA, $I_B = 5.0$ mA
$V_{BE(sat)}$	Pulsed Base Saturation Voltage (Note 4)	0.65		0.85 0.95	V V	$I_C = 10$ mA, $I_B = 1.0$ mA $I_C = 50$ mA, $I_B = 5.0$ mA
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage	40			V	$I_C = 1.0$ mA, $I_B = 0$
f_T	Current Gain Bandwidth Product	300			MHz	$I_C = 10$ mA, $V_{CE} = 20$ V, f = 100 MHz
C_{ob}	Output Capacitance			4.5	pF	$V_{CB} = 5.0$ V, f = 1.0 MHz
C_{ib}	Input Capacitance			10	pF	$V_{EB} = 0.5$ V, f = 1.0 MHz
t_{on}	Turn-On Time		40		ns	$I_C = 10$ mA, $I_{B1} = I_{B2}$ 1.0 mA
t_{off}	Turn-Off Time		200		ns	$I_C = 10$ mA, $I_{B1} = I_{B2}$ 1.0 mA

SYMBOL	CHARACTERISTIC	MPQ MIN	TYP	MAX	UNITS	TEST CONDITIONS
BV_{CBO}	Collector to Base Breakdown Voltage	40			V	$I_C = 10$ μA, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0			V	$I_E = 10$ μA, $I_C = 0$
I_{CBO}	Collector Cutoff Current			50	nA	$V_{CB} = 30$ V, $I_E = 0$
I_{EBO}	Emitter Cutoff Current			50	nA	$V_{EB} = 4.0$ V, $I_C = 0$
h_{FE}	DC Current Gain (Note 4)	40 60 75				$I_C = 0.1$ mA, $V_{CE} = 1.0$ V $I_C = 1.0$ mA, $V_{CE} = 1.0$ V $I_C = 10$ mA, $V_{CE} = 1.0$ V
$V_{CE(sat)}$	Pulsed Collector Saturation			0.25	V	$I_C = 10$ mA, $I_B = 1.0$ mA
$V_{BE(sat)}$	Pulsed Base Saturation Voltage (Note 4)			0.85	V	$I_C = 10$ mA, $I_B = 1.0$ mA
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage	40			V	$I_C = 1.0$ mA, $I_B = 0$
f_T	Current Gain Bandwidth Product	200			MHz	$I_C = 10$ mA, $V_{CE} = 20$ V, f = 100 MHz
C_{ob}	Output Capacitance			4.5	pF	$V_{CB} = 5.0$ V, f = 1.0 MHz
C_{ib}	Input Capacitance			10	pF	$V_{EB} = 0.5$ V, f = 1.0 MHz
t_{on}	Turn-On Time		40		ns	$I_C = 10$ mA, $I_{B1} = I_{B2}$ 1.0 mA
t_{off}	Turn-Off Time		200		ns	$I_C = 10$ mA, $I_{B1} = I_{B2}$ 1.0 mA

FAIRCHILD

A Schlumberger Company

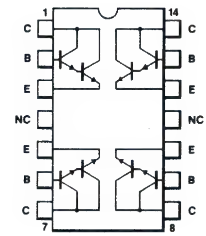
FPQ6426/MPQ6426 FQSO6426

Quad NPN Darlington Transistor

The 6502 features two NPN and two PNP complementary silicon transistors in one package. The transistors are similar to 2N2222 and 2N2907 devices.

- **High Breakdown Voltage**
- **JEDEC (TO-116) 14-Pin Plastic DIP (FPQ/MPQ)**
- **Auto-Insertion Compatible**
- **Gull wing surface mount package (FQSO)**

Connection Diagram



PACKAGE

FPQ6426	TO-116
MPQ6426	TO-116
FQSO6426	14 SOIC

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	−55° C to 150° C
Operating Junction Temperature	150° C
Lead Temperature (Soldering, 10 s)	275° C

Power Dissipation (Notes 2, 3 & 5)

	FPQ/MPQ	**FQSO***
Total Dissipation at $T_A = 25°C$	900 mW	1.0 W
Derate above 25° C	7.2 mW/° C	8.0 mW/° C
Power Dissipation at $T_A = 25°C$ Each Transistor	500 mW	300 mW
Derate above 25° C	4.0 mW/° C	2.4 mW/° C

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage	30 V
V_{CBO}	Collector to Base Voltage	40 V
V_{EBO}	Emitter to Base Voltage	12 V
I_C	Collector Current	500 mA

Electrical Characteristics (25° C Ambient Temperature unless otherwise noted) (Note 5)

SYMBOL	CHARACTERISTIC	FPQ/FQSO MIN	FPQ/FQSO MAX	MPQ MIN	MPQ MAX	UNITS	TEST CONDITIONS
BV_{CBO}	Collector to Base Breakdown Voltage	40		40		V	$I_C = 100\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	12		12		V	$I_E = 10\ \mu A$, $I_C = 0$
I_{CBO}	Collector Cutoff Current		50		100	nA	$V_{CB} = 30$ V, $I_E = 0$
I_{EBO}	Emitter Cutoff Current		100		100	nA	$V_{EB} = 10$ V, $I_C = 0$

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and junction-to-ambient thermal resistance of 139° C/W (derating factor of 7.2 mW/° C).
4. Pulse conditions: length = 300 μs; duty cycle = 1%.
5. FQSO power dissipation data is only an estimate, and may be subject to change without notice.
6. For product family characteristic curves, refer to Curve Set T164.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

Electrical Characteristics (25° C Ambient Temperature unless otherwise noted) (Note 5)

SYMBOL	CHARACTERISTIC	FPQ/FQSO MIN	FPQ/FQSO MAX	MPQ MIN	MPQ MAX	UNITS	TEST CONDITIONS
h_{FE}	DC Current Gain (Note 4)	5000 10000		5000 10000			$I_C = 10$ mA, $V_{CE} = 5.0$ V $I_C = 100$ mA, $V_{CE} = 5.0$ V
$V_{CE(sat)}$	Pulsed Collector Saturation Voltage (Note 4)		1.5		1.5	V	$I_C = 100$ mA, $I_B = 0.1$ mA
$V_{BE(ON)}$	Pulsed Base-Emitter "On" Voltage (Note 4)		2.0		2.0	V	$I_C = 100$ mA, $V_{CE} = 5.0$ V
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage	30		30		V	$I_C = 10$ mA, $I_B = 0$
f_T	Current Gain Bandwidth Product	125		125		MHz	$I_C = 10$ mA, $V_{CE} = 5.0$ V, f = 100 MHz
C_{ob}	Output Capacitance		8.0		8.0	pF	$V_{CB} = 10$ V, f = 1.0 MHz
C_{ib}	Input Capacitance		15		15	pF	$V_{EB} = 0.5$ V, f = 1.0 MHz

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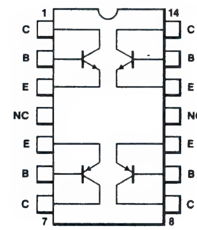
FPQ6502/MPQ6502
FQSO6502

Quad Complementary Pair Transistor

The 6426 features four NPN silicon darlington transistors in one package. The transistors are similar to MPSA13.

- **h_{FE} ... 5000 (Min.) @ 10 mA**
- **JEDEC (TO-116) 14-Pin Plastic DIP (FPQ/MPQ)**
- **Auto-Insertion Compatible**
- **Gull wing surface mount package (FQSO)**

Connection Diagram



PACKAGE

FPQ6502	TO-116
MPQ6502	TO-116
FQSO6502	14 SOIC

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2, 3 & 5)

Total Dissipation at	**FPQ/MPQ**	**FQSO***
T_A = 25° C	1.25 W	1.0 W
Derate above 25° C	10 mW/° C	8.0 mW/° C
Power Dissipation at		
T_A = 25° C Each Transistor	0.65 W	300 mW
Derate above 25° C	5.2 mW/° C	2.4 mW/° C

Voltages & Currents		**FPQ/FQSO**	**MPQ**
V_{CEO}	Collector to Emitter Voltage	40 V	30 V
V_{CBO}	Collector to Base Voltage	60 V	
V_{EBO}	Emitter to Base Voltage	5.0 V	
I_C	Collector Current	500 mA	

Electrical Characteristics (25° C Ambient Temperature unless otherwise noted) (Note 5)

SYMBOL	CHARACTERISTIC	FPQ/FQSO MIN	FPQ/FQSO MAX	MPQ MIN	MPQ MAX	UNITS	TEST CONDITIONS
BV_{CBO}	Collector to Base Breakdown Voltage	60		60		V	$I_C = 10\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0		5.0		V	$I_E = 10\ \mu A$, $I_C = 0$
I_{CBO}	Collector Cutoff Current		20		30	nA	$V_{CB} = 50$ V, $I_E = 0$
I_{EBO}	Emitter Cutoff Current		20		30	nA	$V_{EB} = 3.0$ V, $I_C = 0$

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and junction-to-ambient thermal resistance of 100° C/W (derating factor of 10 mW/° C).
4. Pulse conditions: length = 300 μs; duty cycle = 1%.
5. FQSO power dissipation data is only an estimate, and may be subject to change without notice.
6. For product family characteristic curves, refer to Curve Set T145 for NPN and T212 for PNP.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

Electrical Characteristics (25° C Ambient Temperature unless otherwise noted) (Note 5)

SYMBOL	CHARACTERISTIC	FPQ/FQSO MIN	FPQ/FQSO MAX	MPQ MIN	MPQ MAX	UNITS	TEST CONDITIONS
h_{FE}	DC Current Gain (Note 4)	35					$I_C = 0.1$ mA, $V_{CE} = 10$ V
		50		50			$I_C = 1.0$ mA, $V_{CE} = 10$ V
		75		75			$I_C = 10$ mA, $V_{CE} = 10$ V
		100		100			$I_C = 150$ mA, $V_{CE} = 10$ V
				30			$I_C = 300$ mA, $V_{CE} = 10$ V
		30					$I_C = 500$ mA, $V_{CE} = 10$ V
$V_{CE(sat)}$	Pulsed Collector Saturation Voltage (Note 4)		0.4		0.4	V	$I_C = 150$ mA, $I_B = 15$ mA
			1.0		1.4	V	$I_C = 300$ mA, $I_B = 30$ mA
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage	40		30		V	$I_C = 10$ mA, $I_B = 0$
f_T	Current Gain Bandwidth Product	200		200		MHz	$I_C = 50$ mA, $V_{CE} = 20$ V, f = 100 MHz
C_{ob}	Output Capacitance		8.0		8.0	pF	$V_{CB} = 10$ V, f = 1.0 MHz
C_{ib}	Input Capacitance		30		30	pF	$V_{EB} = 2.0$ V, f = 1.0 MHz

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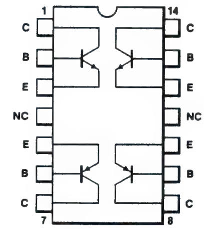
FPQ6700/MPQ6700 FQSO6700

Quad Complementary Pair Transistor

The 6700 features two NPN and two PNP silicon transistors in one package. The transistors are similar to 2N3904 and 2N3906 devices.

- **Fast Switching**
- **JEDEC (TO-116) 14-Pin Plastic DIP (FPQ/MPQ)**
- **Auto-Insertion Compatible**
- **Gull wing surface mount package (FQSO)**

Connection Diagram



PACKAGE

FPQ6700	TO-116
MPQ6700	TO-116
FQSO6700	14 SOIC

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C
Lead Temperature (Soldering, 10 s)	275° C

Power Dissipation (Notes 2, 3 & 5)

	FPQ/MPQ	FQSO*
Total Dissipation at T_A = 25° C	900 mW	1.0 W
Derate above 25° C	7.2 mW/° C	8.0 mW/° C
Power Dissipation at T_A = 25° C Each Transistor	500 mW	300 mW
Derate above 25° C	4.0 mW/° C	2.4 mW/° C

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage	40 V
V_{CBO}	Collector to Base Voltage	40 V
V_{EBO}	Emitter to Base Voltage	5 V
I_C	Collector Current	200 mA

Electrical Characteristics (25° C Ambient Temperature unless otherwise noted) (Note 5)

SYMBOL	CHARACTERISTIC	FPQ/FQSO MIN	TYP	MAX	UNITS	TEST CONDITIONS
BV_{CBO}	Collector to Base Breakdown Voltage	40			V	$I_C = 10\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0			V	$I_E = 10\ \mu A$, $I_C = 0$
I_{CBO}	Collector Cutoff Current			20	nA	$V_{CB} = 30$ V, $I_E = 0$
I_{EBO}	Emitter Cutoff Current			20	nA	$V_{EB} = 4.0$ V, $I_C = 0$

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and junction-to-ambient thermal resistance of 139° C/W (derating factor of 7.2 mW/° C).
4. Pulse conditions: length = 300 μs; duty cycle = 1%.
5. FQSO power dissipation data is only an estimate, and may be subject to change without notice.
6. For product family characteristic curves, refer to Curve Set T144 for NPN and T215 for PNP.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

SYMBOL	CHARACTERISTIC	FPQ/FQSO MIN	TYP	MAX	UNITS	TEST CONDITIONS
h_{FE}	DC Current Gain (Note 4)	40 70 100 60				$I_C = 0.1$ mA, $V_{CE} = 1.0$ V $I_C = 1.0$ mA, $V_{CE} = 1.0$ V $I_C = 10$ mA, $V_{CE} = 1.0$ V $I_C = 50$ mA, $V_{CE} = 1.0$ V
$V_{CE(sat)}$	Pulsed Collector Saturation Voltage (Note 4)			0.25 0.5	V V	$I_C = 10$ mA, $I_B = 1.0$ mA $I_C = 50$ mA, $I_B = 5.0$ mA
$V_{BE(sat)}$	Pulsed Base Saturation Voltage (Note 4)			0.85 1.0	V V	$I_C = 10$ mA, $I_B = 1.0$ mA $I_C = 50$ mA, $I_B = 5.0$ mA
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage	40			V	$I_C = 10$ mA, $I_B = 0$
f_T	Current Gain Bandwidth Product	250			MHz	$I_C = 10$ mA, $V_{CE} = 20$ V, f = 100 MHz
C_{ob}	Output Capacitance			4.5	pF	$V_{CB} = 5.0$ V, f = 1.0 MHz
C_{ib}	Input Capacitance NPN PNP			 8.0 10	 pF pF	 $V_{EB} = 0.5$ V, f = 1.0 MHz $V_{EB} = 0.5$ V, f = 1.0 MHz
t_{on}	Turn-On Time		40		ns	$I_C = 10$ mA, $I_{B1} = I_{B2}$ 1.0 mA
t_{off}	Turn-Off Time		200		ns	$I_C = 10$ mA, $I_{B1} = I_{B2}$ 1.0 mA

SYMBOL	CHARACTERISTIC	MIN	MPQ TYP	MAX	UNITS	TEST CONDITIONS
BV_{CBO}	Collector to Base Breakdown Voltage	40			V	$I_C = 10$ μA, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0			V	$I_E = 10$ μA, $I_C = 0$
I_{CBO}	Collector Cutoff Current			50	nA	$V_{CB} = 30$ V, $I_E = 0$
I_{EBO}	Emitter Cutoff Current			50	nA	$V_{EB} = 4.0$ V, $I_C = 0$
h_{FE}	DC Current Gain (Note 4)	30 50 70				$I_C = 0.1$ mA, $V_{CE} = 1.0$ V $I_C = 1.0$ mA, $V_{CE} = 1.0$ V $I_C = 10$ mA, $V_{CE} = 1.0$ V
$V_{CE(sat)}$	Pulsed Collector Saturation			0.25	V	$I_C = 10$ mA, $I_B = 1.0$ mA
$V_{BE(sat)}$	Pulsed Base Saturation Voltage (Note 4)			0.9	V	$I_C = 10$ mA, $I_B = 1.0$ mA
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage	40			V	$I_C = 10$ mA, $I_B = 0$
f_T	Current Gain Bandwidth Product	200			MHz	$I_C = 10$ mA, $V_{CE} = 20$ V, f = 100 MHz
C_{ob}	Output Capacitance			4.5	pF	$V_{CB} = 5.0$ V, f = 1.0 MHz
C_{ib}	Input Capacitance NPN PNP			 8.0 10	 pF pF	 $V_{EB} = 0.5$ V, f = 1.0 MHz $V_{EB} = 0.5$ V, f = 1.0 MHz
t_{on}	Turn-On Time		40		ns	$I_C = 10$ mA, $I_{B1} = I_{B2}$ 1.0 mA
t_{off}	Turn-Off Time		200		ns	$I_C = 10$ mA, $I_{B1} = I_{B2}$ 1.0 mA

FPT100/A/B
FPT110/A/B

General Purpose Silicon Planar Phototransistor

General Description

The FPT100 and FPT110 are 3-terminal npn Planar phototransistors with exceptionally stable characteristics and high illumination-sensitivity. The availability of the base pin gives wide latitude for flexible circuit design. The case is made of a special plastic compound with transparent resin encapsulation that exhibits stable characteristics under high humidity conditions. The controlled sensitivities offered in the A and B versions give the circuit designer increased flexibility.

PACKAGE

FPT100	OPTO-26
FPT100A	OPTO-26
FPT100B	OPTO-26
FPT110	OPTO-28
FPT110A	OPTO-28
FPT110B	OPTO-28

3

Exceptionally Stable Characteristics
Controlled Sensitivities

ABSOLUTE MAXIMUM RATINGS

Temperatures & Humidity

Storage Temperature	-55° C to 100° C
Operating Temperature	-55° C to 85° C
Relative Humidity at 65° C	85%

Power Dissipation (Notes 1 & 2)

Total Dissipation at	
T_C = 25° C	200 mW
T_A = 25° C	100 mW

Voltages & Currents (Note 5)

V_{CB}	Collector-to-Base Voltage	50 V
V_{CES}	Collector-to-Emitter Sustaining Voltage (Note 3)	30 V
I_C	Collector Current	25 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 9)

SYMBOL	CHARACTERISTIC	MIN	TYP	MAX	UNITS	TEST CONDITIONS
BV_{ECO}	Emitter-to-Collector Breakdown Voltage (Note 5)		7.0		V	I_E = 100 μA
BV_{CBO}	Collector-to-Base Breakdown Voltage (Note 5)	50	120		V	I_C = 100 μA

NOTES:

1. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
2. These ratings give a maximum junction temperature of 85° C and junction-to-case thermal resistance of 300° C/W (derating factor of 3.33 mW/° C, and a junction-to-ambient thermal resistance of 600° C/W (derating factor of 1.67 mW/° C).
3. Measured at noted irradiance as emitted from a tungsten filament lamp at a color temperature of 2854° K. The effective photosensitive area is typically 1.25 mm² (FPT100A/B) and 0.78 mm² (FPT110A/B).
4. These are values obtained at noted irradiance as emitted from a GaAs source at 900 nm.
5. Measured with radiation flux intensity of less than 0.1 μW/cm² over the spectrum from 100-1500 nm.
6. Rise time is defined as the time required for I_{CE} to rise from 10% to 90% of peak value. Fall time is defined as the time required for I_{CE} to decrease from 90% to 10% of peak value. Test conditions are: V_C = 5.0 V, I_{CE} = 4.0 mA, R_L = 100 Ω, GaAs source.
7. No electrical connection to base lead.
8. No electrical connection to emitter lead.
9. For product family characteristic curves, refer to Curve Set FPT100.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 9)

SYMBOL	CHARACTERISTIC	MIN	TYP	MAX	UNITS	TEST CONDITIONS
I_{CEO}	Collector Dark Current (Note 5)		2.0	100	nA	$V_{CE} = 5.0$ V
I_{CBO}	Collector Dark Current (Note 5)		0.25 0.025	25 0.5	nA μA	$V_{CB} = 10$ V $V_{CB} = 10$ V, $T_A = 65°$
$I_{CE(lt)}$	Photo Current, Tungsten Source (Notes 3 & 7) (FPT100/A/B) (FPT110/A/B)	 0.2 0.2	 1.4 0.88		mA	$V_{CE} = 5.0$ V, $H = 5.0$ mW/cm^2
$I_{CE(lt)}$	Photo Current, GaAs Source (Notes 4 & 7) (FPT110/A/B) (FPT110/A/B)	 0.6 0.6	 4.2 2.7		mA	$V_{CE} = 5.0$ V, $H = 5.0$ mW/cm^2
$V_{CE(sat)}$	Collector-to-Emitter Saturation Voltage (FPT100/A/B) (FPT110/A/B)		 0.16 0.16	 0.3 0.33	V	$I_C = 500$ μA, $H = 20$ mW/cm^2
$V_{CEO(sus)}$	Collector-to-Emitter Sustaining Voltage (Note 5)	30	50		V	$I_C = 1.0$ mA (pulsed)
t_r	Light Current Rise Time (Note 6)		2.8		μs	
t_f	Light Current Fall Time (Note 6)		2.8		μs	
R_{CB}	Responsivity, Tungsten Source (Notes 3 and 8) (FPT100/A/B) (FPT110/A/B)	 0.6 0.6	 1.6 1.0		μA/ mW/cm^2	$V_{CE} = 10$ V
R_{CB}	Responsivity, GaAs Source (Notes 4 and 8) (FPT100/A/B) (FPT110/A/B)	 1.8 1.8	 4.8 3.0		μA/ mW/cm^2	$V_{CE} = 10$ V

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FPT120/A/B/C
FPT130/A/B

High Sensitivity Silicon Phototransistors

General Description

The FPT120/A/B/C and FPT130/A/B are silicon nitride protected NPN Planar phototransistors with exceptionally stable characteristics and high illumination-sensitivity. The case is made of a special plastic compound with transparent resin encapsulation. The controlled sensitivities offered in the A, B and C versions give the circuit designer increased flexibility.

PACKAGE

FPT120	OPTO-26
FPT120A	OPTO-26
FPT120B	OPTO-26
FPT120C	OPTO-26
FPT130	OPTO-28
FPT130A	OPTO-28
FPT130B	OPTO-28

High Illumination Sensitivity

Availability of Base Pins for Flexible Circuit Design

ABSOLUTE MAXIMUM RATINGS

Temperatures & Humidity

Storage Temperature	-55° C to 150° C
Operating Temperature	-55° C to 85° C
Pin Temperature (Soldering, 5 s)	260° C
Relative Humidity at 65° C	85%

Power Dissipation (Note 1)

Total Device Dissipation at T_C = 25° C	200 mW
Total Dissipation at T_A = 25° C	100 mW

Voltages & Currents

$V_{CE(sus)}$ Collector-to-Emitter Sustaining Voltage (Note 4)	20 V
I_C Collector Current	25 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 9)

SYMBOL	CHARACTERISTIC	MIN	TYP	MAX	UNITS	TEST CONDITIONS
BV_{ECO}	Emitter-to-Collector Breakdown Voltage (Note 5)		5.0		V	I_{EC} = 100 μA
I_{CEO}	Collector Dark Current (Note 5)		10	100	nA	V_{CE} = 5.0 V

NOTES:

1. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
2. These ratings give a maximum junction temperature of 85° C and junction-to-case thermal resistance of 300° C/W (derating factor of 33.3 mW/° C).
3. Measured at noted irradiance as emitted from a tungsten filament lamp at a color temperature of 2854° K. The effective photosensitive area is typically 1.25 mm² (FPT120A/B) and 0.78 mm² (FPT130A/B).
4. These are values obtained at noted irradiance as emitted from a GaAs source at 900 nm.
5. Measured with radiation flux intensity of less than 0.1 μW/cm² over the spectrum from 100-1500 nm.
6. Rise time is defined as the time required for I_{CE} to rise from 10% to 90% of peak value. Fall time is defined as the time required for I_{CE} to decrease from 90% to 10% of peak value. Test conditions are: V_C = 5.0 V, I_{CC} = 4.0 mA, R_L = 100 Ω, GaAs source.
7. Same electrical characteristics as FPT120 except for $I_{CE(lt)}$.
8. Same electrical characteristics as FPT130 except for $I_{CE(lt)}$.
9. For product family characteristic curves, refer to Curve Set FPT120.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 9)

SYMBOL	CHARACTERISTIC	MIN	TYP	MAX	UNITS	TEST CONDITIONS
$I_{CE(lt)}$	Photo Current, Tungsten Source (Note 3)				mA	V_{CE} = 5.0 V, H = 5 mW/cm^2
	(FPT120)	2.0	7.5			
	(FPT120A) (Note 7)	7.5		22.5		
	(FPT120B) (Note 7)	10		20		
	(FPT120C) (Note 7)	16		25		
	(FPT130)	2.0	4.5			
	(FPT130A) (Note 8)	4.5		13.5		
	(FPT130B) (Note 8)	6.0		12		
$I_{CE(lt)}$	Photo Current, GaAs Source (Note 4)				mA	V_{CE} = 5.0 V, H = 1 mW/cm^2
	(FPT120)	0.7	4.5			
	(FPT130)	0.7	2.7			
$V_{CEO(sus)}$	Collector-to-Emitter Sustaining Voltage (Note 5)	20	50		V	I_C = 1 mA (pulsed)
$V_{CE(sat)}$	Collector-to-Emitter Saturation Voltage, Tungsten Source (Note 3)	0.25	0.55		V	I_C = 1 mA (pulsed), H = 20 mW/cm^2
t_r	Light Current Rise Time (Note 6)		18		μs	
t_f	Light Current Fall Time (Note 6)		18		μs	

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FPT320

High Sensitivity Silicon Phototransistors

Description

The FPT320 is a silicon nitride protected NPN Planar phototransistor with exceptionally stable characteristics and high illumination-sensitivity. The case is made of a special plastic compound with transparent resin encapsulation.

PACKAGE

FPT320	OPTO-26

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 100° C
Operating Temperature	-55° C to 85° C
Pin Temperature (Soldering, 5 s)	260°
Relative Humdity at 65° C	85%

Power Dissipation (Note 1)

Total Dissipation at T_C = 25° C	200 mW
Derate Linearly from 25° C	3.33 mW/° C
Total Dissipation at T_A = 25°	100 mW
Derate Linearly from 25° C	1.67 mW/° C

Voltages & Current

$V_{CE(sus)}$	Collector to Emitter Voltage	20 V
I_C	Collector Current	25 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 7)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
$I_{CE(lt)}$	Photo Current, GaAs Source (Note 3)	0.7		mA	V_{CE} = 5.0 V, H = 1 mW/cm^2
I_{CEO}	Collector Dark Current (Note 4)		100	nA	V_{CE} = 5.0 V
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Note 4)	20		V	I_C = 1.0 mA (pulsed)
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage, Tungsten Source (Note 2)		0.55	V	I_C = 1.0 mA, H = 20 mW/cm^2

NOTES:

1. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
2. Measured at noted irradiance as emitted from a tungsten filament lamp at a color temperature of 2854° K.
3. These are values obtained at noted irradiance as emitted from a GaAs source at 99 nm.
4. Measured with radiation flux intensity of less than 0.1 μW/cm^2 over the spectrum from 100-1500 nm.
5. Same electrical characteristics as FPT120 except for $I_{CE(lt)}$.
6. Same electrical characteristics as FPT130 except for $I_{CE(lt)}$.
7. For product family characteristic curves, refer to Curve Set FPT120.

FAIRCHILD

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FSA1410M/FSA1411M FSA2002M/FSA2003M

Monolithic Air Isolated Diode Arrays

- **C . . . 5.0 pF MAX**
- **ΔV_F . . . 15 mV (MAX) @ 10 mA**

PACKAGES

FSA1410M	TO-96
FSA1411M	TO-96
FSA2002M	TO-85
FSA2003M	TO-85

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature Range	−55°C to +200°C
Maximum Junction Operating Temperature	+150°C
Lead Temperature	+260°C

Power Dissipation (Note 2)

Maximum Dissipation per Junction at 25°C Ambient	400 mW
per Package at 25°C Ambient	600 mW
Linear Derating Factor (from 25°C) Junction	3.2 mW/°C
Package	4.8 mW/°C

Maximum Voltage and Currents

WIV	Working Inverse Voltage	55 V
I_F	Continuous Forward Current	350 mA
$i_{f(surge)}$	Peak Forward Surge Current	
	Pulse Width = 1.0 s	1.0 A
	Pulse Width = 1.0 μs	2.0 A

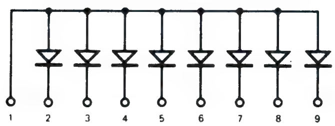
For SOIC power dissipation, consult factory.

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted)

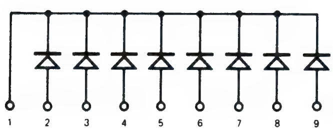
SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
B_V	Breakdown Voltage	60		Volts	$I_R = 10\ \mu A$
V_F	Forward Voltage (Note 3)		1.5 1.1 1.0	Volts Volts Volts	$I_F = 500$ mA $I_F = 200$ mA $I_F = 100$ mA
I_R	Reverse Current Reverse Current ($T_A = 150°C$)		100 100	nA μA	$V_R = 40$ V $V_R = 40$ V
C	Capacitance		5.0	pF	$V_R = 0$, f = 1 MHz
V_{FM}	Peak Forward Voltage		4.0	Volts	$I_f = 500$ mA, $t_r < 10$ ns
t_{fr}	Forward Recovery Time		40	ns	$I_f = 500$ mA, $t_r < 10$ ns
t_{rr}	Reverse Recovery Time		10 50	ns ns	$I_f = I_r = 10-200$ mA $R_L = 100\ \Omega$, Rec. to 0.1 I_r $I_f = 500$ mA, $I_r = 50$ mA $R_L = 100\ \Omega$, Rec. to 5 mA
ΔV_F	Forward Voltage Match		15	mV	$I_F = 10$ mA

NOTES:
1. These ratings are limiting values above which life or satisfactory performance may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operation.
3. V_F is measured using an 8 ms pulse.
4. For product family characteristic curves and test circuits, refer to Chapter 4, D15.

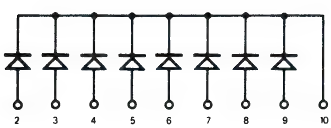
Connection Diagrams



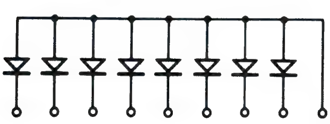
FSA1410M



FSA1411M



FSA2002M



FSA2003M

FAIRCHILD

A Schlumberger Company

FSA2500M/FSA2501M FSA2501P/FSA2502M FASO2501

Monolithic Air Isolated Diode Arrays

- **C...5.0 pf (MAX)**
- **V_F...15 mV (MAX) @ 10 mA**

PACKAGES

FSA2500M	TO-85
FSA2501M	TO-116-2
FSA2501P	TO-116
FSA2502M	TO-96
FASO2501	14-SOIC

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature Range (M Suffix)	−55° C to +200° C
(P Suffix)	−55° C to +150° C
Maximum Junction Operating Temperature	+150° C
Lead Temperature	+260° C

Power Dissipation (Note 2)

Maximum Dissipation per Junction at 25° C Ambient	400 mW
Maximum Dissipation per Package at 25° C Ambient	650 mW
Linear Derating Factor (from 25° C) Junction	3.2 mW/° C
Package	5.2 mW/° C

Maximum Voltage and Currents

WIV	Working Inverse Voltage	50 V
I_F	Continuous Forward Current	350 mA
i_f (surge)	Peak Forward Surge Current	
	Pulse Width = 1.0 s	1.0 A
	Pulse width = 1.0 μs	2.0 A

For SOIC power dissipation, consult factory.

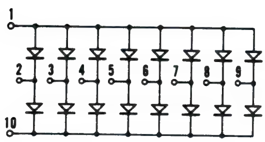
ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV	Breakdown Voltage	60		V	I_R = 10 μA
V_F	Forward Voltage (Note 3)		1.1 1.2 1.5	V V V	I_F = 200 mA I_F = 300 mA I_F = 500 mA
ΔV_F	Forward Voltage Match (Note 6)		15	mV	I_F = 10 mA
I_R	Reverse Current (Note 4)		100 200	nA μA	V_R = 50 V V_R = 50 V, T_A = 125° C
C	Capacitance (Note 5)		5.0	pF	V_R = 0, f = 1.0 MHz
t_{fr}	Forward Recovery Time (Note 6)		40	ns	I_f = 500 mA
t_{rr}	Reverse Recovery Time (Note 6)		10 50	ns ns	$I_f = I_r$ = 10 mA to 200 mA R_L = 100 Ω, I_{rr} = 0.1 I_R I_f = 500 mA, I_r = 50 mA R_L = 100 Ω, I_{rr} = 5.0 mA

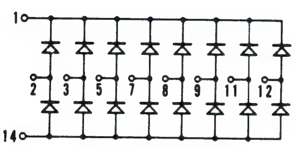
NOTES:
1. These ratings are limiting values above which life or satisfactory performance may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty-cycle operation
3. V_F is measured using an 8 ms pulse.
4. See test circuits (Note 6) for measurement of reverse current of an individual diode.
5. The capacitance is measured from pin-to-pin across any one of the diodes. The interaction of other diodes is therefore included in the measured value.
6. For product family characteristic curves and test circuits refer to Chapter 4, D15.

FSA2500M/FSA2501M
FSA2501P/FSA2502M
FASO2501

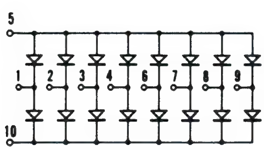
Connection Diagrams



FSA2500M



FSA2501M FSA2501P
FASO2501



FSA2502P

FAIRCHILD

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FSA2503M/FSA2503P FSA2504M/FASO2503

Monolithic Air Isolated Diode Arrays

- C . . . 5.0 pF (MAX)
- ΔF . . . 15 mV (MAX) @ 10 mA

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature Range (M Suffix)	−55°C to +200°C
(P Suffix)	−55°C to +150°C
Maximum Junction Operating Temperature	+150°C
Lead Temperature	+260°C

Power Dissipation (Note 2)

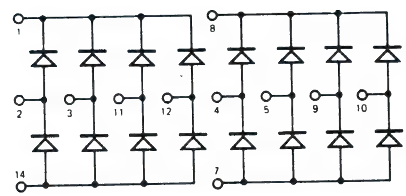
Maximum Dissipation per Junction at 25°C Ambient	400 mW
Maximum Dissipation per Package at 25°C Ambient	650 mW
Linear Derating Factor (from 25°C) Junction	3.2 mW/°C
Package	5.2 mW/°C

Maximum Voltage and Currents

WIV	Working Inverse Voltage	50 V
I_F	Continuous Forward Current	350 mA
i_f (surge)	Peak Forward Surge Current	
	Pulse Width = 1.0 s	1.0 A
	Pulse Width = 1.0 μs	2.0 A

For SOIC power dissipation, consult factory.

CONNECTION DIAGRAM



PACKAGES

FSA2503M	TO-116-2
FSA2503P	TO-116
FSA2504M	TO-86
FASO2503	14-SOIC

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV	Breakdown Voltage	60		V	$I_R = 10\ \mu A$
V_F	Forward Voltage (Note 3)		1.0 1.1 1.5	V V V	$I_F = 100$ mA $I_F = 200$ mA $I_F = 500$ mA
ΔV_F	Forward Voltage Match (Note 6)		15	mV	$I_F = 10$ mA
I_R	Reverse Current (Note 4)		100 200	nA μA	$V_R = 50$ V $V_R = 50$ V, $T_A = 125°C$
C	Capacitance (Note 5)		5.0	pF	$V_R = 0$, f = 1.0 MHz
t_{fr}	Forward Recovery Time (Note 6)		40	ns	$I_f = 500$ mA
t_{rr}	Reverse Recovery Time (Note 6)		10 50	ns ns	$I_f = I_r = 10$ mA to 200 mA $R_L = 100\ \Omega$, $I_{rr} = 0.1\ I_R$ $I_f = 500$ mA, $I_r = 50$ mA $R_L = 100\ \Omega$, $I_{rr} = 5.0$ mA

NOTES:
1. These ratings are limiting values above which life or satisfactory performance may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty-cycle operation.
3. V_F is measured using an 8 ms pulse.
4. See test circuits (Note 6) for measurement of reverse current of an individual diode.
5. The capacitance is measured from pin-to-pin across any one of the diodes. The interaction of other diodes is therefore included in the measured value.
6. For product family characteristics and test circuits, refer to Chapter 4-D15.

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FSA2509M/FSA2509P FSA2510M/FSA2510P FASO2509/FASO2510

Monolithic Air Isolated Diode Arrays

- **C . . . 5.0 pF (MAX)**
- **ΔV_F . . . 15 mV (MAX) @ 10 mA**

PACKAGES

FSA2509M	TO-116-1
FSA2509P	TO-116
FSA2510M	TO-116-2
FSA2510P	TO-116
FASO2509	14-SOIC
FASO2510	14-SOIC

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature Range (M Suffix)	−55°C to +200°C
(P Suffix)	−55°C to +150°C
Maximum Junction Operating Temperature	+150°C
Lead Temperature	+260°C

Power Dissipation (Note 2)

Maximum Dissipation per Junction at 25°C Ambient	400 mW
Maximum Dissipation per Package at 25°C Ambient	650 mW
Linear Derating factor (from 25°C) Junction	3.2 mW/°C
Package	5.2 mW/°C

Maximum Voltage and Currents

WIV	Working Inverse Voltage	40 V
I_F	Continuous Forward Current	350 mA
$i_{f(surge)}$	Peak Forward Surge Current	
	Pulse Width = 1.0 s	1.0 A
	Pulse Width = 1.0 μs	2.0 A

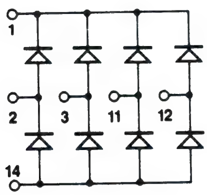
For SOIC power dissipation, consult factory.

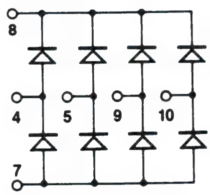
ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV	Breakdown Voltage	60		V	I_R = 10 μA
V_F	Forward Voltage (Note 3)		1.0 1.1 1.3	V V V	I_F = 100 mA I_F = 200 mA I_F = 500 mA
ΔV_F	Forward Voltage Match (Note 6)		15	mV	I_F = 10 mA
I_R	Reverse Current (Note 4)		100 200	nA μA	V_R = 40 V V_R = 40 V, T_A = 150°C
C	Capacitance (Note 5)		5.0	pF	V_R = 0, f = 1.0 MHz
t_{fr}	Forward Recovery Time (Note 6)		40	ns	I_f = 500 mA
t_{rr}	Reverse Recovery Time (Note 6)		10 50	ns ns	$I_f = I_r$ = 10 mA to 200 mA R_L = 100 Ω, I_{rr} = 0.1 I_R I_f = 500 mA, I_r = 50 mA R_L = 100 Ω, I_{rr} = 5.0 mA

NOTES:
1. These ratings are limiting values above which life or satisfactory performance may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty-cycle operation.
3. V_F is measured using an 8 ms pulse.
4. See test circuits (Note 6) for measurement of reverse current of an individual diode.
5. The capacitance is measured from pin-to-pin across any one of the diodes. The interaction of other diodes is therefore included in the measured value.
6. For product family characteristic curves and test circuits, refer to Chapter 4, D15.

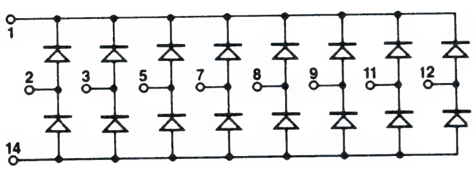
Connection Diagrams





FSA2509M
FASO2509

FSA2509P



FSA2510M
FASO2510

FSA2510P

FAIRCHILD

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FSA2563M/2564M/2565M FSA2566M/FSA2563P FSA2564P/2565P/2566P FASO2563/2564/2565/2566

Monolithic Air Isolated Diode Arrays

- **C...3.0 pf (max)**
- **V_F...15 mV (max) @ 10 mA**

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature Range (M Suffix)	−55°C to +200°C
(P Suffix)	−55°C to +150°C
Maximum Junction Operating Temperature	+150°C
Lead Temperature	+260°C

Power Dissipation (Note 2)

Maximum Dissipation per Junction at 25°C Ambient	400 mW
Maximum Dissipation per Package at 25°C Ambient	650 mW
Linear Derating Factor (from 25°C) Junction	3.2 mW/°C
Package	5.2 mW/°C

Maximum Voltage and Currents

WIV	Working Inverse Voltage	40 V
I_F	Continuous Forward Current	350 mA
i_f (surge)	Peak Forward Surge Current	
	Pulse Width = 1.0 s	1.0 A
	Pulse Width = 1.0 μs	2.0 A

For SOIC power dissipation, consult factory.

PACKAGES

FSA2563M	TO-116-2
FSA2564M	TO-116-2
FSA2565M	TO-6B
FSA2566M	TO-6B
FSA2563P	TO-116
FSA2564P	TO-116
FSA2565P	TO-9B
FSA2566P	TO-9B
FASO2563	14-SOIC
FASO2564	14-SOIC
FASO2565	16-SOIC
FASO2566	16-SOIC

3

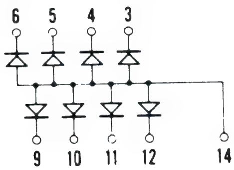
ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV	Breakdown Voltage	60		V	I_R = 10 μA
V_F	Forward Voltage (Note 3)		1.0 1.1 1.3	V V V	I_F = 100 mA I_F = 200 mA I_F = 500 mA
I_R	Reverse Current (Note 4)		100 100	nA μA	V_R = 40 V V_R = 40 V, T_A = 125°C
C	Capacitance (Note 5)		4	pF	V_R = 0 V, f = 1 MHz
V_{FM}	Peak Forward Voltage (Note 6)		4	V	I_F = 500 mA
t_{fr}	Forward Recovery Time (Note 6)		40	ns	I_f = 500 mA
t_{rr}	Reverse Recovery Time (Note 6)		10 50	ns ns	$I_f = I_r$ = 10 mA to 200 mA R_L = 100Ω, $I_{rr} = 0.1\ I_r$ I_f = 500 mA, I_r = 50 mA R_L = 100Ω, I_{rr} = 5 mA
ΔV_F	Forward Voltage Match (Note 6)		15	mV	I_F = 10 mA

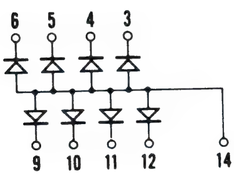
NOTES:

1. These ratings are limiting values above which life or satisfactory performance may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty-cycle operation.
3. V_F is measured using an 8 μs pulse.
4. See test circuits (Note 6) for measurement of reverse current of an individual diode.
5. The capacitance is measured from pin-to-pin across any one of the diodes. The interaction of other diodes is therefore included in the measured value.
6. For product family characteristic curves and test circuits, refer to Chapter 4, D15.

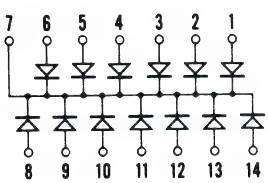
Connection Diagrams



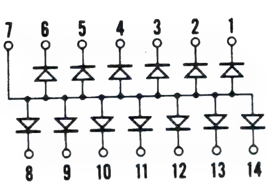
FSA2563M FSA2563P
FASO2563



FSA2564M FSA2564P
FASO2564



FSA2565M FSA2565P
FASO2565



FSA2566M FSA2566P
FASO2566

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FSA2619M/2620M/2621M FSA2619P/2620P FASO2619/20 FSA2719M/2720M/2721M FSA2719P/2720P FASO2719/20

Monolithic Air Isolated Diode Arrays

- **C . . . 2.0 pf (max) FSA2719 Series**
- **ΔV_F . . . 15 mV (max) @ 10 mA**

ABSOLUTE MAXIMUM RATINGS (Notes 1 and 5)

Temperatures

Storage Temperature Range (M Suffix)	−55° C to +200° C
(P Suffix)	−55° C to +150° C
Maximum Junction Operating Temperature	+150° C
Lead Temperature	+260° C

Power Dissipation (Note 2)

Maximum Dissipation per Junction at 25° C Ambient	400 mW
Maximum Dissipation per Package at 25° C Ambient	650 mW
Linear Derating factor (from 25° C) Junction	3.2 mW/°C
Package	5.2 mW/°C

Maximum Voltage and Currents

WIV	Working Inverse Voltage FSA2619 (Note 5)	75 V
	FSA2719	50 V
I_F	Continuous Forward Current	350 mA
i_f (surge)	Peak Forward Surge Current	
	Pulse Width = 1.0 s	1.0 A
	Pulse Width = 1.0 μs	2.0 A

For SOIC power dissipation, consult factory.

PACKAGES

FSA2619M	6B (Ceramic DIP)
FSA2719M	6B (Ceramic DIP)
FSA2619P	9B (Plastic DIP)
FSA2719P	9B (Plastic DIP)
FSA2620M	TO-116-2
FSA2720M	TO-116-2
FSA2620P	TO-116
FSA2720P	TO-116
FSA2621M	TO-86
FSA2721M	TO-86
FASO2619	16-SOIC
FASO2620	14-SOIC
FASO2719	16-SOIC
FASO2720	14-SOIC

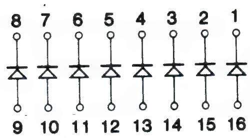
3

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted)

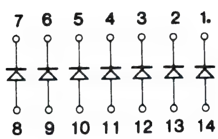
SYMBOL	CHARACTERISTIC		MIN	MAX	UNITS	TEST CONDITIONS
BV	Breakdown Voltage (Note 5)	FSA2719	75		V	I_R = 5.0 μA
		FSA2619	100		V	I_R = 100 μA
I_R	Reverse Current	FSA2619		5.0	μA	V_R = 75 V
				25	nA	V_R = 20 V
				50	μA	V_R = 20 V, T_A = 150° C
		FSA2719		100	nA	V_R = 50 V
				100	μA	V_R = 50 V, T_A = 150° C
V_F	Forward Voltage (Note 3)			1.0	V	I_F = 10 mA
t_{rr}	Reverse Recovery Time (Note 6)	FSA2619		5.0	ns	$I_f = I_r$ = 10 mA, I_{rr} = 1.0 mA
		FSA2719		6.0	ns	$I_f = I_r$ = 10 mA, I_{rr} = 1.0 mA
C	Capacitance (Note 6)	FSA2619		4.0	pF	V_R = 0
		FSA2719		4.0	pF	V_R = 0
ΔV_F	Forward Voltage Match (Note 6)			15	mV	I_F = 10 mA
t_{fr}	Forward Recovery Time (Note 6)	FSA2619		20	ns	50 mA Peak square wave, 0.1 μs Pulse Width, 5.0 kHz - 100 kHz
V_{FM}	Peak Forward Voltage (Note 6)	FSA2719		3.0	V	I_F = 100 mA, $t_r \leq$ 10 ns
RE	Rectification Efficiency		45		%	V_f = 2 V r.m.s. f = 100 MHz

NOTES:
1. These ratings are limiting values above which life or satisfactory performance may be impaired.
2. These are steady state limits. The factory should be consulted or applications involving pulsed or low duty-cycle operation.
3. V_F is measured using an 8 ms pulse.
4. See test circuits (Note 6) for measurement of reverse current of an individual diode.
5. FSA2619 denotes series FSA2619M/P, FSA2620M/P and FSA2621M;
   FSA2719 denotes series FSA2719M/P, FSA2720M/P and FSA2721M.
6. For product family characteristics curves and test circuits, refer to Chapter 4, D15.

Connection Diagrams



FSA2619 FSA2719
FASO2619 FASO2719



FSA2620 FSA2621
FSA2720 FSA2721
FASO2620 FASO2720

FSA2702M/FSA2703M FSA2704M/FSA2705M

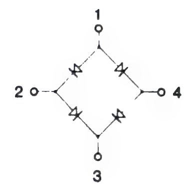
Monolithic Air Isolated Diode Arrays

- **ΔV_F...3 mV (MAX) FSA2702M, FSA2703M**
- **ΔI_R...1 μA (MAX) FSA2702M, FSA2703M**

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures		
Storage Temperature Range		−55°C to +200°C
Maximum Junction Operating Temperature		175°C
Lead Temperature		+260°C
Power Dissipation (Note 2)		
Maximum Dissipation		500 mW
Linear Derating Factor (from 25°C)		3.33 mW/°C
Maximum Voltage and Currents		
WIV	Working Inverse Voltage	40 V
I_F	Continuous Forward Current	300 mA
i_f	Recurrent Peak Forward Current	600 mA
i_f (surge)	Peak Forward Surge Current	
	Pulse Width = 1.0 s	1.0 A
	Pulse Width = 1.0 μs	4.0 A

CONNECTION DIAGRAM



PACKAGE

FSA2702M	TO-33
FSA2703M	TO-33
FSA2704M	TO-72
FSA2705M	TO-72

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV	Breakdown Voltage	60		V	I_R = 100 μA
I_R	Reverse Current (Note 4)		100 100	nA μA	V_R = 40 V V_R=40 V, T_A = 150°C
C	Capacitance (Note 5)		4.0	pF	V_R = 0
V_F	Forward Voltage (Note 3)		1.000 .920 .850 .780 .740 .700 .650 .620	V V V V V V V V	I_F = 200 mA I_F = 100 mA I_F = 50 mA I_F = 20 mA I_F = 10 mA I_F = 5.0 mA I_F = 2.0 mA I_F = 1.0 mA
t_{rr}	Reverse Recovery Time (Note 6)		6.0 10	ns ns	$I_f = I_r$ = 10 mA, I_{rr} = 1.0 mA $I_f = I_r$ = 200 mA, I_{rr} = 20 mA
ΔV_f	Forward Voltage Match (Note 6) FSA2702, FSA2703		3.0	mV	I_F = 10 μA to 10 mA T_A = −55°C to +100°C
ΔI_R	Reverse Current Match (Note 6) FSA2702, FSA2703		1.0	μA	V_R = 10 V, T_A = −55°C to +100°C

NOTES:
1. These ratings are limiting values above which life or satisfactory performance may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty-cycle operation.
3. V_F is measured using an 8 ms pulse.
4. See test circuits (Note 6) for measurement of reverse current of an individual diode.
5. The capacitance is measured from pin-to-pin across any one of the diodes. The interaction of other diodes is therefore included in the measured value.
6. For product family characteristic curves and test circuits, refer to Chapter 4, D15.

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MPS2924/FTSO2924

NPN Small Signal General Purpose Amplifier

- V_{CEO}. **25 V (Min)**
- **h_{FE} . . . 150-300 @ 2.0 mA**

PACKAGE

MPS2924	TO-92
FTSO2924	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	**MPS**	**FTSO**
25° C Ambient Temperature	0.625 W	0.350 W*
70° C Ambient Temperature	0.400 W	
25° C Case Temperature	1.0 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	25 V
V_{CBO}	Collector to Base Voltage	25 V
V_{EBO}	Emitter to Base Voltage	5.0 V
I_C	Collector Current	100 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 5)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
I_{CBO}	Collector Cutoff Current		500 15	nA μA	$V_{CB} = 25$ V, $I_E = 0$ $V_{CB} = 25$ V, $I_E = 0$, $T_A = 100°$
I_{EBO}	Emitter Cutoff Current		500	nA	$V_{EB} = 5.0$ V, $I_C = 0$
h_{fe}	Small Signal Current Gain	150	300		$V_{CE} = 10$ V, $I_C = 2.0$ mA, f = 1.0 kHz
C_{ob}	Output Capacitance		12	pF	$V_{CB} = 10$ V, $I_E = 0$, f = 1.0 MHz

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. For product family characteristic curves, refer to Curve Set T144.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

FAIRCHILD

A Schlumberger Company

MPS3392/FTSO3392
MPS3393/FTSO3393

NPN Small Signal General Purpose Amplifiers

- V_{CEO} . . . 25 V (Min)
- h_{FE} . . . 150-300 (MPS/FTSO3392), 90-180 (MPS/FTSO3393) @ 2.0 mA
- Complements . . . 2N4125, 2N4126

PACKAGE

MPS3392	TO-92
MPS3393	TO-92
FTSO3392	TO-236AA/AB
FTSO3393	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	MPS	FTSO
25° C Ambient Temperature	0.625 W	0.350 W*
70° C Ambient Temperature	0.400 W	
25° C Case Temperature	1.0 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	25 V
V_{CBO}	Collector to Base Voltage	25 V
V_{EBO}	Emitter to Base Voltage	5.0 V
I_C	Collector Current	100 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	3392 MIN	3392 MAX	3393 MIN	3393 MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage	25		25		V	$I_C = 1.0$ mA, $I_B = 0$
I_{EBO}	Emitter Cutoff Current		100		100	nA	$V_{EB} = 5.0$ V, $I_C = 0$
I_{CBO}	Collector Cutoff Current		100		100	nA	$V_{CB} = 18$ V, $I_E = 0$
h_{FE}	DC Current Gain (Note 5)	150	300	90	180		$I_C = 2.0$ mA, $V_{CE} = 4.5$ V
C_{ob}	Output Capacitance		3.5		3.5	pF	$V_{CB} = 10$ V, $I_E = 0$, f = 1.0 MHz
h_{fe}	Small Signal Current Gain	150	500	90	400		$I_C = 2.0$ mA, $V_{CE} = 4.5$ V, f = 1.0 kHz

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T144.

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MPS3702/FTSO3702
MPS3703/FTSO3703

PNP Small Signal General Purpose Amplifier

- **V_{CEO} ... -30 V (Min) (MPS/FTSO3703)**
- **h_{FE} ... 60-300 @ 50 mA (MPS/FTSO3702)**
- **$V_{CE(sat)}$ ... -0.25 V (Max) @ 50 mA**
- **Complements ... MPS/FTSO3704, MPS/FTSO3705**

PACKAGE

MPS3702	TO-92
MPS3703	TO-92
FTSO3702	TO-236AA/AB
FTSO3703	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (MPS3702, MPS3703) (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	**MPS**	**FTSO**
25° C Ambient Temperature	0.625 W	0.350 W*
70° C Ambient Temperature	0.400 W	
25° C Case Temperature	1.0 W	

Voltages & Currents		**3702**	**3703**
V_{CEO}	Collector to Emitter Voltage (Note 4)	-25 V	-30 V
V_{CBO}	Collector to Base Voltage	-40 V	-50 V
V_{EBO}	Emitter to Base Voltage	-5.0 V	-5.0 V
I_C	Collector Current	200 mA	200 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	3702 MIN	3702 MAX	3703 MIN	3703 MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage (Note 5)	–25		–30		V	$I_C = 10$ mA, $I_B = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	–40		–50		V	$I_C = 100$ μA, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	–5.0		–5.0		V	$I_E = 100$ μA, $I_C = 0$
I_{CBO}	Collector Cutoff Current		100		100	nA	$V_{CB} = -20$ V, $I_E = 0$
I_{EBO}	Emitter Cutoff Current		100		100	nA	$V_{EB} = -3.0$ V, $I_C = 0$

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T212.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	3702 MIN	3702 MAX	3703 MIN	3703 MAX	UNITS	TEST CONDITIONS
h_{FE}	DC Current Gain (Note 5)	60	300	30	150		$I_C = 50$ mA, $V_{CE} = -5.0$ V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		−0.25		−0.25	V	$I_C = 50$ mA, $I_B = 5.0$ mA
$V_{BE(ON)}$	Base to Emitter "On" Voltage (Note 5)	−0.6	−1.0	−0.6	−1.0	V	$I_C = 50$ mA, $V_{CE} = -5.0$ V
f_T	Current Gain Bandwidth Product	100		100		MHz	$I_C = 50$ mA, $V_{CE} = -5.0$ V, f = 20 MHz
C_{ob}	Output Capacitance		12		12	pF	$V_{CB} = -10$ V, f = 1.0 MHz

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MPS3704/FTSO3704
MPS3705/FTSO3705

NPN Small Signal General Purpose Amplifiers

- V_{CEO} ... 30 V (Min)
- h_{FE} ... 100-300 @ 50 mA (MPS/FTSO3704)
- $V_{CE(sat)}$ ... -0.6 V (Max) @ 100 mA (MPS/FTSO3704)
- Complements ... MPS/FTSO3702, MPS/FTSO3703

PACKAGE

MPS3704	TO-92
MPS3705	TO-92
FTSO3704	TO-236AA/AB
FTSO3705	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	MPS	FTSO
25° C Ambient Temperature	0.625 W	0.350 W*
70° C Ambient Temperature	0.400 W	
25° C Case Temperature	1.0 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	30 V
V_{CBO}	Collector to Base Voltage	50 V
V_{EBO}	Emitter to Base Voltage	5.0 V
I_C	Collector Current	600 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	3704 MIN	3704 MAX	3705 MIN	3705 MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage (Note 5)	30		30		V	$I_C = 10$ mA, $I_E = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	50		50		V	$I_C = 100\ \mu$A, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0		5.0		V	$I_E = 100\ \mu$A, $I_C = 0$
I_{CBO}	Collector Cutoff Current		100		100	nA	$V_{CB} = 20$ V, $I_E = 0$
I_{EBO}	Emitter Cutoff Current		100		100	nA	$V_{EB} = 3.0$ V, $I_C = 0$
h_{FE}	DC Current Gain (Note 5)	100	300	50	150		$I_C = 50$ mA, $V_{CE} = 2.0$ V

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T145.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	3704 MIN	3704 MAX	3705 MIN	3705 MAX	UNITS	TEST CONDITIONS
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.6		0.8	V	$I_C = 100$ mA, $I_B = 5.0$ mA
$V_{BE(ON)}$	Base to Emitter "On" Voltage (Note 5)	0.5	1.0	0.5	1.0	V	$I_C = 100$ mA, $V_{CE} = 2.0$ V
f_T	Current Gain Bandwidth Product	100		100		MHz	$I_C = 50$ mA, $V_{CE} = 2.0$ V, f = 20 MHz
C_{ob}	Output Capacitance		12		12	pF	$V_{CB} = 10$ V, $I_E = 0$, f = 1.0 MHz

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MPS5172/FTSO5172

NPN Small Signal General Purpose Amplifier

- **h_{FE} ... 100-500 @ I_C = 10 mA**
- **$V_{CE(sat)}$ ... 0.25 V (Max) @ I_C = 10 mA**
- **Complements ... 2N4126, FTSO4126**

PACKAGE	
MPS5172	TO-92
FTSO5172	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	**MPS**	**FTSO**
25° C Ambient Temperature	0.625 W	0.350 W*
70° C Ambient Temperature	0.400 W	
25° C Case Temperature	1.0 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	25 V
V_{CBO}	Collector to Base Voltage	25 V
V_{EBO}	Emitter to Base Voltage	5.0 V
I_C	Collector Current	100 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage	25		V	$I_C = 10$ mA, $I_B = 0$
I_{CES}	Collector Cutoff Current		100	nA	$V_{CE} = 25$ V, $V_{BE} = 0$
I_{CBO}	Collector Cutoff Current		100 10	nA μA	$V_{CB} = 25$ V, $I_E = 0$ $V_{CB} = 25$ V, $I_E = 01$, $T_A = 100°$ C
I_{EBO}	Emitter Cutoff Current		100	nA	$V_{BE} = 5.0$ V, $I_C = 0$
h_{FE}	DC Current Gain (Note 5)	100	500		$I_C = 10$ mA, $V_{CE} = 10$ V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.25	V	$I_C = 10$ mA, $I_B = 1.0$ mA
$V_{BE(ON)}$	Base to Emitter "On" Voltage	0.5	1.2	V	$I_C = 10$ mA, $V_{CE} = 10$ V
C_{cb}	Collector to Base Capacitance	1.6	10	pF	$V_{CB} = 0$, $I_E = 0$, f = 1.0 MHz
h_{fe}	Small Signal Current Gain	100	750		$I_C = 10$ mA, $V_{CE} = 10$ V, f = 1.0 kHz

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T144.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

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MPS6514/FTSO6514
MPS6515/FTSO6515

NPN Small Signal General Purpose Amplifiers

- **V_{CEO} . . . 25 V (Min)**
- **h_{FE} . . . 150-300 (MPS/FTSO6514), 250-500 (MPS/FTSO6515) @ 2.0 mA**
- **h_{FE} . . . 90 (Min) (MPS/FTSO6514), 150 (Min) (MPS/FTSO6515) @ 100 mA**

PACKAGE

MPS6514	TO-92
MPS6515	TO-92
FTSO6514	TO-236AA/AB
FTSO6515	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	**MPS**	**FTSO**
25° C Ambient Temperature	0.625 W	0.350 W*
70° C Ambient Temperature	0.400 W	
25° C Case Temperature	1.0 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	25 V
V_{CBO}	Collector to Base Voltage	40 V
V_{EBO}	Emitter to Base Voltage	4.0 V
I_C	Collector Current	100 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	6514 MIN	6514 MAX	6515 MIN	6515 MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage	30		30		V	$I_C = 0.5$ mA, $I_B = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	4.0		4.0		V	$I_E = 100\ \mu A$, $I_C = 0$
I_{CBO}	Collector Cutoff Current		50 1.0		50 1.0	nA μA	$V_{CB} = 30$ V, $I_E = 0$ $V_{CB} = 30$ V, $I_E = 0$, $T_A = 60°$ C
h_{FE}	DC Current Gain (Note 5)	150 90	300	250 150	500		$I_C = 2.0$ mA, $V_{CE} = 10$ V $I_C = 100$ mA, $V_{CE} = 10$ V
$V_{CE(SAT)}$	Collector to Emitter Saturation Voltage (Note 5)		0.5		0.5	V	$I_C = 50$ mA, $I_B = 5.0$ mA
C_{ob}	Output Capacitance		3.5		3.5	pF	$V_{CB} = 10$ V, $I_E = 0$, f = 100 kHz

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T144 for MPS6514 & T-155 for MPS6515.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

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MPS6518/FTSO6518

PNP Small Signal General Purpose Amplifier

- V_{CEO} ... **40 V (Min)**
- h_{FE} ... **150-300 @ 2.0 mA, 90 (Min) @ 100 mA**

PACKAGE

MPS6518	TO-92
FTSO6518	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	**MPS**	**FTSO**
25° C Ambient Temperature	0.625 W	0.350 W*
70° C Ambient Temperature	0.400 W	
25° C Case Temperature	1.0 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	−40 V
V_{CBO}	Collector to Base Voltage	−40 V
V_{EBO}	Emitter to Base Voltage	−4.0 V
I_C	Collector Current	100 mA

3

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage	−40		V	$I_C = 0.5$ mA, $I_B = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	−4.0		V	$I_E = 10\ \mu$A, $I_C = 0$
I_{CBO}	Collector Cutoff Current		50 1.0	nA μA	$V_{CB} = -30$ V, $I_E = 0$ $V_{CB} = -30$ V, $I_E = 0$, $T_A = 60°$ C
h_{FE}	DC Current Gain (Note 5)	150 90	300		$I_C = 2.0$ mA, $V_{CE} = -10$ V $I_C = 100$ mA, $V_{CE} = -10$ V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		−0.5	V	$I_C = 50$ mA, $I_B = 5.0$ mA
C_{ob}	Output Capacitance		4.0	pF	$V_{CB} = -10$ V, $I_E = 0$, f = 100 kHz

NOTES:
1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T215.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

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MPS6520/FTSO6520
MPS6521/FTSO6521

NPN Small Signal General Purpose Amplifiers

- **V_{CEO} ... 25 V (Min)**
- **h_{FE} ... 100 (Min) (MPS/FTSO6520), 150 (Min) (MPS/FTSO6521) @ 100 μA**
- **h_{FE} ... 200-400 (MPS/FTSO6520), 300-600 (MPS/FTSO6521) @ 2.0 mA**
- **NF ... 3.0 dB (Max) @ I_C = 10 μA, Wide Band**

PACKAGE

MPS6520	TO-92
MPS6521	TO-92
FTSO6520	TO-236AA/AB
FTSO6521	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	**MPS**	**FTSO**
25° C Ambient Temperature	0.625 W	0.350 W*
70° C Ambient Temperature	0.400 W	
25° C Case Temperature	1.0 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	25 V
V_{CBO}	Collector to Base Voltage	40 V
V_{EBO}	Emitter to Base Voltage	4.0 V
I_C	Collector Current	100 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	6520 MIN	6520 MAX	6521 MIN	6521 MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage	25		25		V	I_C = 0.5 mA, I_B = 0
BV_{EBO}	Emitter to Base Breakdown Voltage	4.0		4.0		V	I_E = 10 μA, I_C = 0
I_{CBO}	Collector Cutoff Current		50 1.0		50 1.0	nA μA	V_{CB} = 30 V, I_E = 0 V_{CB} = 30 V, I_E = 0, T_A = 60° C

NOTES:
1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T144.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	6520 MIN	6520 MAX	6521 MIN	6521 MAX	UNITS	TEST CONDITIONS
h_{FE}	DC Current Gain	100		150			$I_C = 100\ \mu A$, $V_{CE} = 10$ V
		200	400	300	600		$I_C = 2.0$ mA, $V_{CE} = 10$ V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.5		0.5	V	$I_C = 50$ mA, $I_B = 5.0$ mA
C_{ob}	Output Capacitance		3.5		3.5	pF	$V_{CB} = 10$ V, $I_E = 0$, f = 100 kHz
NF	Noise Figure		3.0		3.0	dB	$V_{CE} = 5.0$ V, $I_C = 10\ \mu A$, $R_g = 10\ k\Omega$, Power Bandwidth ‡ 15.7 kHz, 3.0 dB pts @ 10 Hz & 10 kHz

3

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MPS6535M

PNP Small Signal General Purpose Amplifier

- P_D **625 mW @ T_A = 25°C**
- **V_{CEO} . . . -30 V (Min)**
- **h_{FE} . . . 30 (Min) @ 100 mA**

PACKAGE

MPS6535M	TO-92

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55°C to 150°C
Operating Junction Temperature	150°C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	
25°C Ambient Temperature	0.625 W
70°C Ambient Temperature	0.400 W
25°C Case Temperature	1.0 W

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	–30 V
V_{CBO}	Collector to Base Voltage	–30 V
V_{EBO}	Emitter to Base Voltage	–4.0 V
I_C	Collector Current	600 mA

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage	–30		V	I_C = 10 mA, I_B = 0
BV_{CBO}	Collector to Base Breakdown Voltage	–30		V	I_C = 10 μA, I_E = 0
BV_{EBO}	Emitter to Base Breakdown Voltage	–4.0		V	I_E = 10 μA, I_C = 0
I_{CBO}	Collector Cutoff Current		100 5.0	nA μA	V_{CB} = –20 V, I_E = 0 V_{CB} = –20 V, I_E = 0, T_A = 60°C
h_{FE}	DC Current Gain (Note 5)	30			I_C = 100 mA, V_{CE} = –1.0 V
$V_{CE(sat)}$	Collector Saturation Voltage (Note 5)		–0.5	V	I_C = 100 mA, I_B = 10 mA
$V_{BE(sat)}$	Base Saturation Voltage (Note 5)		–1.2	V	I_C = 100 mA, I_B = 10 mA
C_{ob}	Output Capacitance		8.0	pF	V_{CB} = –10 V, I_E = 0, f = 100 kHz

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150°C and (TO-92) junction-to-case thermal resistance of 125°C/W (derating factor of 8.0 mW/°C); junction-to-ambient thermal resistance of 200°C/W (derating factor of 5.0 mW/°C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 2%.
6. For product family characteristic curves, refer to Curve Set T202.

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MPS6560/FTSO6560 MPS6561/FTSO6561 MPS6562/FTSO6562

NPN-PNP Small Signal General Purpose Complementary Amplifiers

- **V_{CEO} .. MPS/FTSO6560/2), 20 V (MPS/FTSO6561)**
- **h_{FE} ... 50-200 @ 500 mA (MPS/FTSO6560/2), @ 350 mA (MPS/FTSO6561)**
- **$V_{CE(sat)}$ ... 0.5 V (Max) @ 500 mA (MPS/FTSO6560/2), @ 350 mA (MPS/FTSO6561)**
- **Complements ... MPS/FTSO6560, MPS/FTSO6561 (NPN); MPS/FTSO6562 (PNP)**

PACKAGE

MPS6560	TO-92
MPS6561	TO-92
MPS6562	TO-92
FTSO6560	TO-236AA/AB
FTSO6561	TO-236AA/AB
FTSO6562	TO-236AA/AB

3

ABSOLUTE MAXIMUM RATIN GS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	MPS	FTSO
25° C Ambient Temperature	0.625 W	0.350 W*
70° C Ambient Temperature	0.400 W	
25° C Case Temperature	1.0 W	

Voltages & Currents		6560/62	6561
V_{CEO}	Collector to Emitter Voltage (Note 4)	25 V	20 V
V_{CBO}	Collector to Base Voltage	25 V	20 V
V_{EBO}	Emitter to Base Voltage	4.0 V	4.0 V
I_C	Collector Current	600 mA	600 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	6560/62 MIN	6560/62 MAX	6561 MIN	6561 MAX	UNITS	TEST CONDITIONS
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0		–5.0		V	$I_E = 100\ \mu A$, $I_C = 0$
I_{CEO}	Collector Cutoff Current		100			nA	$V_{CE} = 25$ V, $I_B = 0$
					100	nA	$V_{CE} = 20$ V, $I_B = 0$
I_{CBO}	Collector Cutoff Current		100		100	nA	$V_{CB} = 20$ V, $I_E = 0$
I_{EBO}	Emitter Cutoff Current		100		100	nA	$V_{EB} = 4.0$ V, $I_C = 0$

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T124 for MPS6560, MPS6561 & T12 for MPS6562.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	6560/62 MIN	6560/62 MAX	6561 MIN	6561 MAX	UNITS	TEST CONDITIONS
h_{FE}	DC Current Gain (Note 5)	35 50 50	 200	35 50 50	 200		$I_C = 10$ mA, $V_{CE} = 1.0$ V $I_C = 100$ mA, $V_{CE} = 1.0$ V $I_C = 500$ mA, $V_{CE} = 1.0$ V $I_C = 350$ mA, $V_{CE} = 1.0$ V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.5		 –0.5	V V	$I_C = 500$ mA, $I_B = 50$ mA $I_C = 350$ mA, $I_B = 35$ mA
$V_{BE(ON)}$	Base to Emitter "On" Voltage (Note 5)		1.2		 –1.2	V V	$I_C = 500$ mA, $V_{CE} = 1.0$ V $I_C = 350$ mA, $V_{CE} = 1.0$ V
f_T	Current Gain Bandwidth Product	60		60		MHz	$I_C = 10$ mA, $V_{CE} = 10$ V, f = 30 MHz
C_{ob}	Output Capacitance		30		30	pF	$V_{CB} = 10$ V, $I_E = 0$, f = 100 kHz

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MPS6571/FTSO6571

NPN Low Level High Gain Amplifier

- **V_{CEO} ... -20 V (Min)**
- **h_{FE} ... 250-1000 @ 100 μA**

PACKAGE

MPS6571	TO-92
FTSO6571	TO236AA/AB

ABSOLUTE MAXIMUM RATIN GS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	MPS	FTSO
25° C Ambient Temperature	0.625 W	0.350 W*
70° C Ambient Temperature	0.400 W	
25° C Case Temperature	1.0 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	20 V
V_{CBO}	Collector to Base Voltage	20 V
V_{EBO}	Emitter to Base Voltage	3.0 V
I_C	Collector Current (Continuous)	50 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage	20		V	$I_C = 1.0$ mA, $I_B = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	25		V	$I_C = 100$ μA, $I_E = 0$
I_{CBO}	Collector Cutoff Current		50	nA	$V_{CB} = 20$ V, $I_E = 0$
I_{EBO}	Emitter Cutoff Current		50	nA	$V_{EB(OFF)} = 3.0$ V, $I_C = 0$
h_{FE}	DC Current Gain (Note 5)	250	1000		$I_C = 100$ μA, $V_{CE} = 5.0$ V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.5	V	$I_C = 10$ mA, $I_B = 1.0$ mA
$V_{BE(ON)}$	Base to Emitter "On" Voltage (Note 5)		0.8	V	$I_C = 10$ mA, $V_{CE} = 5.0$ V
f_T	Current Gain Bandwidth Product	50		MHz	$I_C = 500$ μA, $V_{CE} = 5.0$ V, f = 20 MHz
C_{ob}	Output Capacitance		4.5	pF	$V_{CB} = 5.0$ V, $I_E = 0$, f = 100 kHz

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T144.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

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MPSA05/FTSOA05
MPSA06/FTSOA06

NPN Small Signal General Purpose Amplifiers

- **V_{CEO} ... 60 V (Min) (MPS/FTSOA05), 80 V (Min) (MPS/FTSOA06)**
- **h_{FE} ... 50 (Min) @ 10 mA and 100 mA**
- **$V_{CE(sat)}$ ... 0.25 V (Max) @ 100 mA**
- **Complements ... MPS/FTSOA55, MPS/FTSOA56, (PNP)**

PACKAGE

MPSA05	TO-92
MPSA06	TO-92
FTSOA05	TO-236AA/AB
FTSOA06	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	**MPS**	**FTSO**
25° C Ambient Temperature	0.625 W	0.350 W*
70° C Ambient Temperature	0.400 W	
25° C Case Temperature	1.0 W	

Voltages & Currents

		A05	**A06**
V_{CEO}	Collector to Emitter Voltage (Note 4)	60 V	80 V
V_{CBO}	Collector to Base Voltage	60 V	80 V
V_{EBO}	Emitter to Base Voltage	4.0 V	4.0 V
I_C	Collector Current	500 mA	500 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	A05 MIN	A05 MAX	A06 MIN	A06 MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage	60		80		V	$I_C = 1.0$ mA, $I_B = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	4.0		4.0		V	$I_E = 100\ \mu A$, $I_C = 0$
I_{CBO}	Collector Cutoff Current		100			nA	$V_{CB} = 60$ V, $I_E = 0$
					100	nA	$V_{CB} = 80$ V, $I_E = 0$

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T149.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	A05 MIN	A05 MAX	A06 MIN	A06 MAX	UNITS	TEST CONDITIONS
h_{FE}	DC Current Gain (Note 5)	50 50		50 50			$I_C = 100$ mA, $V_{CE} = 1.0$ V $I_C = 10$ mA, $V_{CE} = 1.0$ V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.25		0.25	V	$I_C = 100$ mA, $I_B = 10$ mA
$V_{BE(ON)}$	Base to Emitter "On" Voltage		1.2		1.2	V	$I_C = 100$ mA, $V_{CE} = 1.0$ V
f_T	Current Gain Bandwidth Product	50		50		MHz	$I_C = 100$ mA, $V_{CE} = 1.0$ V, f = 100 MHz

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MPSA10

NPN Amplifier Transistor

- **V_{CEO} . . . 40 V (Min)**

PACKAGE

MPSA10	TO-92

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	
25° C Ambient Temperature	0.625 W
25° C Case Temperature	1.0 W

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	40 V
V_{EBO}	Emitter to Base Voltage	4.0 V
I_C	Collector Current (Peak)	100 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage	40		V	$I_C = 1.0$ mA, $I_B = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	4.0		V	$I_E = 100\ \mu A$, $I_C = 0$
I_{CBO}	Collector Cutoff Current		100	nA	$V_{CB} = 30$ V, $I_E = 0$
h_{FE}	DC Current Gain (Note 5)	40	400		$I_C = 5.0\ \mu A$, $V_{CE} = 10$ V
f_T	Current Gain Bandwidth Product	125		MHz	$I_C = 5.0$ mA, $V_{CE} = 10$ V, f = 100 MHz
C_{obo}	Output Capacitance		4.0	pF	$V_{CB} = 10$ V, $I_E = 0$, f = 100 MHz

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T144.

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MPSA12/FTSOA12

NPN Monolithic Darlington Amplifiers

- V_{CEO} ... **20 V (Min)**
- h_{FE} ... **20,000 (Min) @ 10 mA**

PACKAGE

MPSA12	TO-92
FTSOA12	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	**MPS**	**FTSO**
25° C Ambient Temperature	0.625 W	0.350 W*
70° C Ambient Temperature	0.400 W	
25° C Case Temperature	1.0 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	20 V
V_{EBO}	Emitter to Base Voltage	10 V

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CES}	Collector to Emitter Breakdown Voltage	20		V	$I_C = 100\ \mu A$, $I_B = 0$
I_{CBO}	Collector Cutoff Current		100	nA	$V_{CB} = 15$ V, $I_C = 0$
I_{EBO}	Emitter Cutoff Current		100	nA	$V_{EB} = 10$ V, $I_C = 0$
I_{CES}	Collector Reverse Current		100	nA	$V_{CE} = 15$ V, $V_{BE} = 0$
h_{FE}	DC Pulse Current Gain (Note 5)	20,000			$I_C = 10$ mA, $V_{CE} = 5.0$ V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage		1.0	V	$I_C = 10$ mA, $I_B = 0.01$ mA
$V_{BE(ON)}$	Base to Emitter "On" Voltage		1.4	V	$I_C = 10$ mA, $V_{CE} = 5.0$ V

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T164.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

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MPSA13/FTSOA13
MPSA14/FTSOA14

NPN Monolithic Darlington Amplifiers

- V_{CEO} ... **30 V (Min)**
- h_{FE} ... **20,000 (Min) @ 10.0 mA (MPS/FTSOA14)**

PACKAGE

MPSA13	TO-92
MPSA14	TO-92
FTSOA13	TO-236AA/AB
FTSOA14	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	**MPS**	**FTSO**
25° C Ambient Temperature	0.625 W	0.350 W*
70° C Ambient Temperature	0.400 W	
25° C Case Temperature	1.0 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	30 V
V_{CES}	Collector to Emitter Voltage	30 V
V_{CBO}	Collector to Base Voltage	50 V
V_{EBO}	Emitter to Base Voltage	10 V
I_C	Collector Current	300 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	A13 MIN	A13 MAX	UNITS	TEST CONDITIONS
BV_{CES}	Collector to Emitter Breakdown Voltage	30		V	$I_C = 100\ \mu A$, $I_B = 0$
I_{CBO}	Collector Cutoff Current		100	nA	$V_{CB} = 30$ V, $I_E = 0$
I_{EBO}	Emitter Cutoff Current		100	nA	$V_{EB} = 10$ V, $I_C = 0$
h_{FE}	DC Current Gain (Note 5)	5,000 10,000			$I_C = 10$ mA, $V_{CE} = 5.0$ V $I_C = 100$ mA, $V_{CE} = 5.0$ V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		1.5	V	$I_C = 100$ mA, $I_B = 0.1$ mA
$V_{BE(ON)}$	Base to Emitter "On" Voltage (Note 5)		2.0	V	$I_C = 100$ mA, $V_{CE} = 5.0$ V
f_T	Current Gain Bandwidth Product	125		MHz	$I_C = 10$ mA, $V_{CE} = 5.0$ V, f = 100 MHz

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 2%.
6. For product family characteristic curves, refer to Curve Set T164.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	A14 MIN	A14 MAX	UNITS	TEST CONDITIONS
BV_{CES}	Collector to Emitter Breakdown Voltage	30		V	$I_C = 100\ \mu A$, $I_B = 0$
I_{CBO}	Collector Cutoff Current		100	nA	$V_{CB} = 30$ V, $I_E = 0$
I_{EBO}	Emitter Cutoff Current		100	nA	$V_{EB} = 10$ V, $I_C = 0$
h_{FE}	DC Current Gain (Note 5)	10,000 20,000			$I_C = 10$ mA, $V_{CE} = 5.0$ V $I_C = 100$ mA, $V_{CE} = 5.0$ V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		1.5	V	$I_C = 100$ mA, $I_B = 0.1$ mA
$V_{BE(ON)}$	Base to Emitter "On" Voltage (Note 5)		2.0	V	$I_C = 100$ mA, $V_{CE} = 5.0$ V
f_T	Current Gain Bandwidth Product	125		MHz	$I_C = 10$ mA, $V_{CE} = 5.0$ V, f = 100 MHz

3

FAIRCHILD

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MPSA18

NPN Small Signal Low Noise Low Level Amplifier

- **V_{CEO} . . . 45 V (Min)**
- **h_{FE} . . . 500 (Min) @ 100 μA**
- **NF . . . 0.5 dB (Typ) (Wideband)**

PACKAGE

MPSA18	TO-92

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	
25° C Ambient Temperature	0.625 W
25° C Case Temperature	1.0 W

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	45 V
V_{CBO}	Collector to Base Voltage	45 V
I_C	Collector Current (Peak)	200 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	TYP	MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage	45			V	$I_C = 10$ mA, $I_B = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	45			V	$I_C = 100\ \mu$A, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	6.5			V	$I_E = 10\ \mu$A, $I_C = 0$
I_{CBO}	Collector Cutoff Current			50	nA	$V_{CB} = 30$ V, $I_E = 0$
h_{FE}	DC Current Gain (Note 5)	400 500 500 500		 1500		$I_C = 10\ \mu$A, $V_{CE} = 5.0$ V $I_C = 100\ \mu$A, $V_{CE} = 5.0$ V $I_C = 1.0$ mA, $V_{CE} = 5.0$ V $I_C = 10$ mA, $V_{CE} = 5.0$ V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)			0.2 0.3	V V	$I_C = 10$ mA, $I_B = 0.5$ mA $I_C = 50$ mA, $I_B = 5.0$ mA
$V_{BE(ON)}$	Base to Emitter "On" Voltage (Note 5)			0.7	V	$I_C = 1.0$ mA, $V_{CE} = 5.0$ V

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T107.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	TYP	MAX	UNITS	TEST CONDITIONS
f_T	Current Gain Bandwidth Product	100			MHz	$I_C = 1.0$ mA, $V_{CE} = 5.0$ V, f = 100 kHz
C_{cb}	Collector to Base Capacitance			3.0	pF	$V_{CB} = 5.0$ V, $I_E = 0$, f = 1.0 MHz
C_{eb}	Emitter to Base Capacitance			6.5	pF	$V_{EB} = 0.5$ V, $I_C = 0$, f = 1.0 MHz
NF	Noise Figure		0.5	1.5	dB	$I_C = 100$ μA, $V_{CE} = 5.0$ V, $R_S = 10$ kΩ, f = 10 Hz to 15.7 kHz
			4.0		dB	$I_C = 100$ μA, $V_{CE} = 5.0$ V, $R_S = 10$ kΩ, f = 100 Hz

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MPSA20/FTSOA20
MPSA70/FTSOA70

NPN-PNP Small Signal General Purpose Complementary Amplifiers

- **V_{CEO} ... 40 V (Min)**
- **h_{FE} ... 40-400 @ 5.0 mA**
- **$V_{CE(sat)}$ ... 0.25 V (Max) @ 10 mA**
- **C_{ob} ... 4.0 pF (Max) 10 V**
- **Complements ... MPS/FTSOA20 (NPN), MPS/FTSOA70 (PNP)**

PACKAGE

MPSA20	TO-92
MPSA70	TO-92
FTSOA20	TO-236AA/AB
FTSOA70	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	−55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	MPS	FTSO
25° C Ambient Temperature	0.625 W	0.350 W*
70° C Ambient Temperature	0.400 W	
25° C Case Temperature	1.0 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	40 V
V_{EBO}	Emitter to Base Voltage	4.0 V
I_C	Collector Current (Continuous)	100 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage	40		V	$I_C = 1.0$ mA, $I_B = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	4.0		V	$I_E = 100\ \mu$A, $I_C = 0$
I_{CBO}	Collector Cutoff Current		100	nA	$V_{CB} = 30$ V, $I_E = 0$
h_{FE}	DC Current Gain (Note 5)	40	400		$I_C = 5.0$ mA, $V_{CE} = 10$ V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.25	V	$I_C = 10$ mA, $I_B = 1.0$ mA
f_T	Current Gain Bandwidth Product	125		MHz	$I_C = 5.0$ mA, $V_{CE} = 10$ V, f = 100 MHz
C_{ob}	Output Capacitance		4.0	pF	$V_{CB} = 10$ V, $I_E = 0$, f = 100 kHz

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T144 for MPSA20 & T215 for MPSA70.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

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MPSA42/FTSOA42
MPSA43/FTSOA43

NPN Small Signal High Voltage General Purpose Amplifiers

- V_{CEO} ... **300 V (Min) (MPS/FTSOA42), 200 V (Min) MPS/FTSOA43)**
- h_{FE} ... **40 (Min) @ 10 mA**
- f_T ... **50 MHz (Min)**
- **Complements ... MPSA92, MPSA93**

PACKAGE

MPSA42	TO-92
MPSA43	TO-92
FTSOA42	TO-236AA/AB
FTSOA43	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	**MPS**	**FTSO**
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents		**A42**	**A43**
V_{CEO}	Collector to Emitter Voltage (Note 4)	300 V	200 V
V_{CBO}	Collector to Base Voltage	300 V	200 V
V_{EBO}	Emitter to Base Voltage	8.0 V	6.0 V
I_C	Collector Current (Continuous)	500 mA	500 mA

3

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	A42 MIN	A42 MAX	A43 MIN	A43 MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage (Note 5)	300		200		V	$I_C = 1.0$ mA, $I_B = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	300		200		V	$I_C = 100\ \mu$A, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	8.0		6.0		V	$I_E = 100\ \mu$A, $I_C = 0$
I_{CBO}	Collector Cutoff Current		0.1			μA	$V_{CB} = 200$ V, $I_E = 0$
					0.1	μA	$V_{CB} = 160$ V, $I_E = 0$

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T176.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	A42 MIN	A42 MAX	A43 MIN	A43 MAX	UNITS	TEST CONDITIONS
I_{EBO}	Emitter Cutoff Current		0.1			μA	$V_{EB} = 6.0$ V, $I_C = 0$
					0.1	μA	$V_{EB} = 4.0$ V, $I_C = 0$
h_{FE}	DC Current Gain	25		25			$I_C = 1.0$ mA, $V_{CE} = 10$ V
		40		40			$I_C = 10$ mA, $V_{CE} = 10$ V
		40		50	200		$I_C = 30$ mA, $V_{CE} = 10$ V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage		0.5		0.4	V	$I_C = 20$ mA, $I_B = 2.0$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage		0.9		0.9	V	$I_C = 20$ mA, $I_B = 2.0$ V
f_T	Current Gain Bandwidth Product	50		50		MHz	$I_C = 10$ mA, $V_{CE} = 20$ V, f = 100 MHz
C_{cb}	Collector to Base Capacitance		3.0		4.0	pF	$V_{CB} = 20$ V, $I_E = 0$, f = 1.0 MHz

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MPSA55/FTSOA55
MPSA56/FTSOA56

PNP Small Signal General Purpose Complementary Amplifiers

- **V_{CEO} ... -60 V (Min) (MPS/FTSOA55), -80 V (Min) (MPS/FTSOA56)**
- **h_{FE} ... 50 (Min) @ 100 mA**
- **$V_{CE(sat)}$ ... -0.25 V (Max) @ 100 mA**
- **Complements ... MPS/FTSOA05, MPS/FTSOA06 (NPN)**

PACKAGE

MPSA55	TO-92
MPSA56	TO-92
FTSOA55	TO-236AA/AB
FTSOA56	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	**MPS**	**FTSO**
25° C Ambient Temperature	0.625 W	0.350 W*
70° C Ambient Temperature	0.400 W	
25° C Case Temperature	1.0 W	

Voltages & Currents		**A55**	**A56**
V_{CEO}	Collector to Emitter Voltage (Note 4)	−60 V	−80 V
V_{CBO}	Collector to Base Voltage	−60 V	−80 V
V_{EBO}	Emitter to Base Voltage	−4.0 V	−4.0 V
I_C	Collector Current	500 mA	500 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	A55 MIN	A55 MAX	A56 MIN	A56 MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage	−60		−80		V	$I_C = 1.0$ mA, $I_B = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	−4.0		−4.0		V	$I_E = 100\ \mu A$, $I_C = 0$
I_{CBO}	Collector Cutoff Current		100			nA	$V_{CB} = -60$ V, $I_E = 0$
					100	nA	$V_{CB} = -80$ V, $I_E = 0$

NOTES:
1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T224.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	A55 MIN	A55 MAX	A56 MIN	A56 MAX	UNITS	TEST CONDITIONS
h_{FE}	DC Current Gain (Note 5)	50 50		50 50			$I_C = 10$ mA, $V_{CE} = -1.0$ V $I_C = 100$ mA, $V_{CE} = -1.0$ V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		−0.25		−0.25	V	$I_C = 100$ mA, $I_B = 10$ mA
$V_{BE(ON)}$	Base to Emitter "On" Voltage		−1.2		−1.2	V	$I_C = 100$ mA, $V_{CE} = -1.0$ V
f_T	Current Gain Bandwidth Product	50		50		MHz	$I_C = 100$ mA, $V_{CE} = -1.0$ V, f = 100 MHz

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MPSA92/MPSA93

PNP Small Signal High Voltage General Purpose Amplifiers

- **BV_{CEO} ... -300 V (Min) (MPSA92), -200 V (Min) (MPSOA93)**
- **h_{FE} ... 40 (Min) @ 10 mA**
- **f_T ... 50 MHz (Min)**
- **Complements ... MPSA42, MPSA43**

PACKAGE

MPSA92	TO-92
MPSA93	TO-92

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	
25° C Ambient Temperature	0.625 W
25° C Case Temperature	1.0 W

Voltages & Currents		**A92**	**A93**
V_{CEO}	Collector to Emitter Voltage	−300 V	−200 V
V_{CBO}	Collector to Base Voltage	−300 V	−200 V
V_{EBO}	Emitter to Base Voltage	−5.0 V	−5.0 V
I_C	Collector Current (Continuous)	500 mA	500 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	A92 MIN	A92 MAX	A93 MIN	A93 MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage (Note 4)	−300		−200		V	$I_C = 1.0$ mA, $I_B = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	−300		−200		V	$I_C = 100\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	−5.0		−5.0		V	$I_E = 10\ \mu A$, $I_C = 0$
I_{CBO}	Collector Cutoff Current		0.25			μA	$V_{CB} = -200$ V, $I_E = 0$
					0.25	μA	$V_{CB} = -160$ V, $I_E = 0$
I_{EBO}	Emitter Cutoff Current		0.1		0.1	μA	$V_{EB} = -3.0$ V, $I_C = 0$
h_{FE}	DC Current Gain	25		25			$I_C = 1.0$ mA, $V_{CE} = -10$ V
		40		40			$I_C = 10$ mA, $V_{CE} = -10$ V
		25		30	150		$I_C = 30$ mA, $V_{CE} = -10$ V

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T139.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	A92 MIN	A92 MAX	A93 MIN	A93 MAX	UNITS	TEST CONDITIONS
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage		–0.5		–0.4	V	$I_C = 20$ mA, $I_B = 2.0$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage		–0.9		–0.9	V	$I_C = 20$ mA, $I_B = 2.0$ mA
f_T	Current Gain Bandwidth Product	50		50		MHz	$I_C = 10$ mA, $V_{CE} = -20$ V, f = 100 MHz
C_{cb}	Collector to Base Capacitance		6.0		8.0	pF	$V_{CB} = -20$ V, $I_E = 0$, f = 1.0 MHz

FAIRCHILD

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MPSL01/FTSOL01
MPSL51/FTSOL51

NPN-PNP High Voltage Complementary Small Signal General Purpose Amplifiers

- **V_{CEO} ... 120 V (Min) (MPS/FTSOL01), -100 V (Min) (MPS/FTSOL51)**
- **$V_{CE(sat)}$ ... 0.30 V (Max) @ 50 mA**
- **Complements ... MPS/FTSOL01 (NPN), MPS/FTSOL51 (PNP)**

PACKAGE

MPSL01	TO-92
MPSL51	TO-92
FTSOL01	TO-236AA/AB
FTSOL51	TO-236AA/AB

3

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	**MPS**	**FTSO**
25° C Ambient Temperature	0.625 W	0.350 W*
70° C Ambient Temperature	0.400 W	
25° C Case Temperature	1.0 W	

Voltages & Currents		**L01**	**L51**
V_{CEO}	Collector to Emitter Voltage (Note 4)	120 V	−100 V
V_{CBO}	Collector to Base Voltage	140 V	−100 V
V_{EBO}	Emitter to Base Voltage	5.0 V	−4.0 V
I_C	Collector Current	600 mA	600 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	L01 MIN	L01 MAX	L51 MIN	L51 MAX	UNITS	TEST CONDITIONS (Reverse Voltage Polarity for PNP)
BV_{CEO}	Collector to Emitter Breakdown Voltage (Note 5)	120		−100		V	$I_C = 1.0$ mA, $I_B = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	140		−100		V	$I_C = 100$ µA, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0		−4.0		V	$I_E = 10$ µA, $I_C = 0$
I_{CBO}	Collector Cutoff Current		1.0			µA	$V_{CB} = 75$ V, $I_E = 0$
					1.0	µA	$V_{CB} = 50$ V, $I_E = 0$
I_{EBO}	Emitter Cutoff Current		100			nA	$V_{EB} = 4.0$ V, $I_C = 0$
					100	nA	$V_{EB} = 3.0$ V, $I_C = 0$

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 µs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T147 for MPSL01 & T232 for MPSL51.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	L01 MIN	L01 MAX	L51 MIN	L51 MAX	UNITS	TEST CONDITIONS (Reverse Voltage Polarity for PNP)
h_{FE}	DC Current Gain (Note 5)	50	300				$I_C = 10$ mA, $V_{CE} = 5.0$ V
				40	250		$I_C = 50$ mA, $V_{CE} = 5.0$ V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.20		−0.25	V	$I_C = 10$ mA, $I_B = 1.0$ mA
			0.30		−0.30	V	$I_C = 50$ mA, $I_B = 5.0$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)		1.2		−1.2	V	$I_C = 10$ mA, $I_B = 1.0$ mA
			1.4		−1.2	V	$I_C = 50$ mA, $I_B = 5.0$ mA
f_T	Current Gain Bandwidth Product	60		60		MHz	$I_C = 10$ mA, $V_{CE} = 10$ V, f = 100 MHz
C_{ob}	Output Capacitance		8.0		8.0	pF	$V_{CB} = 10$ V, $I_E = 0$, f = 1.0 MHz
h_{fe}	Small Signal Current Gain	30		20			$I_C = 1.0$ mA, $V_{CE} = 10$ V, f = 1.0 kHz

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PE4010

NPN High Gain Low Noise Type

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	−55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	
25° C Ambient Temperature	0.625 W
70° C Case Temperature	0.400 W
25° C Case Temperature	1.0 W

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage	25 V
V_{CBO}	Collector to Base Voltage	30 V
V_{EBO}	Emitter to Base Voltage	6.0 V

PACKAGE

PE4010	TO-92

3

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	TYP	MAX	UNITS	TEST CONDITIONS
BV_{CBO}	Collector to Base Breakdown Voltage	30			V	$I_C = 100\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	6.0			V	$I_E = 100\ \mu A$, $I_C = 0$
I_{CBO}	Collector Cutoff Current			200	nA	$V_{CB} = 5.0$ V, $I_E = 0$
	(65°)			3.0	μA	$V_{CB} = 5.0$ V, $I_E = 0$
h_{FE}	DC Current Gain	200	350	1000		$I_C = 1.0$ mA, $V_{CE} = 10$ V
			100			$I_C = 50\ \mu A$, $V_{CE} = 10$ V
h_{fe}	High Frequency Current Gain	1.0	1.3			$I_C = 50\ \mu A$, $V_{CE} = 5.0$ V, f = 20 MHz
		3.0				$I_C = 1.0$ mA, $V_{CE} = 5.0$ V, f = 20 MHz
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Notes 3 & 4)	25			V	$I_C = 10$ mA, $I_B = 0$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage			0.35	V	$I_C = 1.0$ mA, $I_B = 0.1$ mA
C_{ob}	Output Capacitance			4.0	pF	$V_{CB} = 5.0$ V, $I_E = 0$
NF	Narrow Band Noise Frequency (Note 5)		1.5	3.0	dB	$I_C = 30\ \mu A$, $V_{CB} = 5.0$ V

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%. R_S = 10 kΩ; f = 1.0 kHz; Power Bandwidth of 200 Hz.
6. For product family characteristic curves, refer to Curve Set T107.

FAIRCHILD

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PE4020

NPN Low Level Low Noise Amplifier

- h_{FE} ... 100 (Min) @ 10 μA, 150 (Min) @ 10 mA
- $V_{CE(sat)}$ ... 0.2 V (Max) @ 10 mA/0.5 mA
- I_{CBO} ... 2.0 nA (Max) @ 45 V, 50 nA (Max) @ 45 V, T_A = 65° C
- NF ... 2.5 dB (Typ) @ 100 Hz; 1.0 kΩ

PACKAGE

PE4020	TO-92

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	
25° C Ambient Temperature	0.625 W
25° C Case Temperature	1.0 W

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	60 V
V_{CBO}	Collector to Base Voltage	60 V
V_{EBO}	Emitter to Base Voltage	8.0 V
I_C	Collector Current (Continuous)	50 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{EBO}	Emitter to Base Breakdown Voltage	8.0		V	$I_E = 10\ \mu A$, $I_C = 0$
BV_{CES}	Collector to Emitter Breakdown Voltage	60		V	$I_C = 10\ \mu A$, $I_B = 0$
I_{CBO}	Collector Cutoff Current		2.0 50	nA nA	$V_{CB} = 45$ V, $I_E = 0$ $V_{CB} = 45$ V, $I_E = 0$, $T_A = 65°$ C
I_{EBO}	Emitter Cutoff Current		1.0	nA	$V_{EB} = 5.0$ V, $I_C = 0$

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and a maximum junction temperature of 125° C and junction-to-case thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); junction-to-ambient thermal resistance of 500° C/W (derating factor of 2.0 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T107.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
h_{FE}	DC Pulse Current Gain (Note 5)	150	950		$I_C = 10$ mA, $V_{CE} = 5.0$ V
h_{FE}	DC Current Gain	135 120 100 25			$I_C = 1.0$ mA, $V_{CE} = 5.0$ V $I_C = 100$ μA, $V_{CE} = 5.0$ V $I_C = 10$ μA, $V_{CE} = 5.0$ V $I_C = 10$ μA, $V_{CE} = 5.0$ V, $T_A = -55°$ C
h_{fe}	High Frequency Current Gain	1.0	2.0		$I_C = 10$ mA, $V_{CE} = 5.0$ V, f = 100 MHz
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Notes 4 & 5)	60		V	$I_C = 5.0$ mA, $I_B = 0$
$V_{BE(ON)}$	Base to to Emitter "On" Voltage		0.7	V	$I_C = 1.0$ mA, $V_{CE} = 5.0$ V
$V_{CE(sat)}$	Pulsed Collector to Emitter Saturation Voltage (Note 5)		0.3 0.2	V V	$I_C = 50$ mA, $I_B = 5.0$ mA $I_C = 10$ mA, $I_B = 0.5$ mA
C_{cb}	Collector to Base Capacitance		4.0	pF	$V_{CB} = 5.0$ V, $I_E = 0$
C_{eb}	Emitter to Base Capacitance		6.0	pF	$V_{EB} = 0.5$ V, $I_C = 0$
NF	Narrow Band Noise Figure		6.0 3.0	dB dB	$I_C = 100$ μA, $V_{CE} = 5.0$ V, f = 1.0 kHz $R_S = 1.0$ kΩ, BW = 400 Hz $I_C = 10$ μA, $V_{CE} = 5.0$ V, f = 1.0 kHz $R_S = 10$ kΩ, BW = 400 Hz
NF	Wide Band Noise Figure		3.0	dB	$I_C = 10$ μA, $V_{CE} = 5.0$ V, f = 10 Hz to 10 kHz $R_S = 10$ kΩ, BW = 15.7 kHz

FAIRCHILD

A Schlumberger Company

PE7058/PE7059

NPN High Voltage Video Output

- **V_{CEO} ... 220 V to 300 V (Min) @ 10 mA**
- **C_{cb} ... 4.0 pF (Max) @ 20 V**
- **f_T ... 40 to 50 MHz (Min)**
- **h_{FE} ... Outstanding Beta Linearity to 100 mA**

PACKAGE

PE7058	TO-92
PE7059	TO-92

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-65° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2, 3 & 6)

Total Dissipation at	
25° C Ambient Temperature	0.625 W
25° C Case Temperature	1.0 W

Voltages & Currents		**7058**	**7059**
BV_{CEO}	Collector to Emitter Voltage (Note 4)	220 V	300 V
BV_{CBO}	Collector to Base Voltage	220 V	300 V
BV_{EBO}	Emitter to Base Voltage	7.0 V	7.0 V
I_C	Collector Current (Continuous)	500 mA	500 mA
I_C	Collector Current (Pulsed)	2.0 A	2.0 A

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	PE7058 MIN	PE7058 MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage (Note 5)	220		V	$I_C = 10$ mA, $I_B = 0$
BV_{CBO}	Collector to Base Breakdown Voltage (Note 5)	220		V	$I_C = 100$ μA, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage (Note 5)	7.0		V	$I_E = 10$ μA, $I_C = 0$
I_{CBO}	Collector Cutoff Current (Note 5)		100	nA	$V_{CB} = 200$ V, $I_E = 0$
I_{CES}	Collector Reverse Current (Note 5)		100	nA	$V_{CE} = 100$ V, $V_{BE} = 0$
I_{EBO}	Emitter Cutoff Current		100	nA	$V_{EB} = 6.0$ V, $I_C = 0$
h_{FE}	DC Current Gain (Note 5)	20 40 40 15			$I_C = 1.0$ mA, $V_{CE} = 20$ V $I_C = 10$ mA, $V_{CE} = 20$ V $I_C = 30$ mA, $V_{CE} = 20$ V $I_C = 150$ mA, $V_{CE} = 20$ V

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO92) junction-to-case thermal resistance of 125° C/W (derating factor of 5.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T176.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	PE7058 MIN	PE7058 MAX	UNITS	TEST CONDITIONS
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		1.0	V	$I_C = 20$ mA, $I_B = 2.0$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)	0.65	0.85	V	$I_C = 20$ mA, $I_B = 2.0$ mA
f_T	High Frequency Current Gain	40 40 40 40		MHz MHz MHz MHz	$I_C = 30$ mA, $V_{CE} = 10$ V, f = 20 MHz $I_C = 30$ mA, $V_{CE} = 20$ V, f = 20 MHz $I_C = 30$ mA, $V_{CE} = 40$ V, f = 20 MHz $I_C = 15$ mA, $V_{CE} = 100$ V, f = 20 MHz
C_{cb}	Collector to Base Capacitance		4.0	pF	$V_{CB} = 20$ V, $I_E = 0$, f = 1.0 MHz
C_{eb}	Emitter to Base Capacitance		70	pF	$V_{EB} = 0.5$ V, $I_C = 0$, f = 1.0 MHz

SYMBOL	CHARACTERISTIC	PE7059 MIN	PE7059 MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage (Note 5)	300		V	$I_C = 10$ mA, $I_B = 0$
BV_{CBO}	Collector to Base Breakdown Voltage (Note 5)	300		V	$I_C = 100$ μA, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage (Note 5)	7.0		V	$I_E = 10$ μA, $I_C = 0$
I_{CBO}	Collector Cutoff Current (Note 5)		100	nA	$V_{CB} = 200$ V, $I_E = 0$
I_{CES}	Collector Reverse Current (Note 5)		100	nA	$V_{CE} = 100$ V, $V_{BE} = 0$
I_{EBO}	Emitter Cutoff Current		100	nA	$V_{EB} = 6.0$ V, $I_C = 0$
h_{FE}	DC Current Gain (Note 5)	20 40 40 10			$I_C = 1.0$ mA, $V_{CE} = 20$ V $I_C = 10$ mA, $V_{CE} = 20$ V $I_C = 30$ mA, $V_{CE} = 20$ V $I_C = 150$ mA, $V_{CE} = 20$ V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		1.0	V	$I_C = 20$ mA, $I_B = 2.0$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)	0.65	0.85	V	$I_C = 20$ mA, $I_B = 2.0$ mA
f_T	High Frequency Current Gain	40 40 40 40		MHz MHz MHz MHz	$I_C = 30$ mA, $V_{CE} = 10$ V, f = 20 MHz $I_C = 30$ mA, $V_{CE} = 20$ V, f = 20 MHz $I_C = 30$ mA, $V_{CE} = 40$ V, f = 20 MHz $I_C = 15$ mA, $V_{CE} = 100$ V, f = 20 MHz
C_{cb}	Collector to Base Capacitance		4.0	pF	$V_{CB} = 20$ V, $I_E = 0$, f = 1.0 MHz
C_{eb}	Emitter to Base Capacitance		70	pF	$V_{EB} = 0.5$ V, $I_C = 0$, f = 1.0 MHz

3

FAIRCHILD

A Schlumberger Company

PE8050/PE8550

NPN-PNP General Purpose Complementary Amplifiers & Output Drivers

- **V_{CEO} . . . 25 V (Min)**
- **h_{FE} . . . Outstanding Beta Linearity to 1.0 A**
- **Three h_{FE} Groups**
- **Guaranteed SOA**
- **Complements . . . PE8050, (NPN), PE8550, (PNP)**

PACKAGE

PE8050	TO-92
PE8550	TO-92

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	−55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (V_{CE} = 8.0 V) (Notes 2 & 3)

Total Dissipation at	
25° C Ambient Temperature	0.625 W
25° C Case Temperature	1.0 W

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	25 V
V_{CBO}	Collector to Base Voltage	30 V
V_{EBO}	Emitter to Base Voltage	6.0 V
I_C	Collector Current (Continuous)	1.5 A
I_C	Collector Current (Pulsed)	1.5 A

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
V_{CEO}	Collector to Emitter Breakdown Voltage (Note 5)	25		V	I_C = 10 mA, I_B = 0
V_{CBO}	Collector to Base Breakdown Voltage	30		V	I_C = 100 μA, I_E = 0
V_{EBO}	Emitter to Base Breakdown Voltage	6.0		V	I_E = 100 μA, I_C = 0
I_{CBO}	Collector Cutoff Current		100	nA	V_{CB} = 20 V, I_E = 0
h_{FE}	DC Current Gain (Note 5)	50	200		I_C = 10 mA, V_{CE} = 1.0 V
		65	200		I_C = 100 mA, V_{CE} = 1.0 V
		65	200		I_C = 500 mA, V_{CE} = 1.0 V
		40	200		I_C = 1.0 A, V_{CE} = 1.0 V
	Gain Grouping A	65	130		I_C = 100 mA, V_{CE} = 1.0 V
	Gain Grouping B	85	160		
	Gain Grouping C	120	200		

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 5.0 mW/° C); junction-to-ambient thermal resistance of 125° C/W (derating factor of 8.0 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T124 for PE8050 & T202 for PE8550.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
h_{FE1}/h_{FE2}	Beta Ratio at Two Currents	0.8	1.8		$I_{C1} = 100$ mA, $I_{C2} = 800$ mA, $V_{CE} = 1.0$ V
h_{FE3}/h_{FE4}	Beta Ratio at Two Currents	0.8	1.5		$I_{C1} = 150$ mA, $I_{C4} = 500$ mA, $V_{CE} = 1.0$ V
h_{fe}	High Frequency Current Gain	1.0			$I_C = 50$ mA, $V_{CE} = 10$ V, f = 100 MHz
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.15 0.5	V V	$I_C = 200$ mA, $I_B = 20$ mA $I_C = 1.0$ A, $I_B = 100$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)		0.9 1.2	V V	$I_C = 200$ mA, $I_B = 20$ mA $I_C = 1.0$ A, $I_B = 100$ mA
C_{cb}	Collector to Base Capacitance		40	pF	$V_{CB} = 10$ V, $I_C = 0$, f = 1.0 MHz

3

FAIRCHILD

A Schlumberger Company

PN918/MPS918/FTSO918
PN3563/MPS3563/FTSO3563

NPN Small Signal High Frequency Amplifiers & Oscillators

- G_{PE} ... 15 dB (Min) @ 200 MHz (PN/FTSO918)
- C_{OB} ... 1.7 pF (Max) @ 10 V
- NF ... 6.0 dB (Max) @ 60 MHz

PACKAGE

PN918	TO-92
PN3563	TO-92
MPS918	TO-92
MPS3563	TO-92
FTSO918	TO-236AA/AB
FTSO3563	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	−55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	PN/MPS	FTSO
25° C Ambient Temperature	0.625 W	0.350 W*
65° C Ambient Temperature	0.300 W	
25° C Case Temperature	1.0 W	

Voltages & Currents

		3563	918
V_{CEO}	Collector to Emitter Voltage (Note 4)	12 V	12 V
V_{CBO}	Collector to Base Voltage	30 V	30 V
V_{EBO}	Emitter to Base Voltage	2.0 V	3.0 V
I_C	Collector Current	50 mA	50 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	3563 MIN	3563 MAX	MPS918 MIN	MPS918 MAX	UNITS	TEST CONDITIONS
BV_{CBO}	Collector to Base Breakdown Voltage	30				V	$I_C = 100\ \mu A$, $I_E = 0$
				30		V	$I_C = 10\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	2.0		3.0		V	$I_E = 10\ \mu A$, $I_C = 0$
I_{CBO}	Collector Cutoff Current		50		10	nA	$V_{CB} = 15$ V, $I_E = 0$
h_{FE}	DC Current Gain (Note 5)			20			$I_C = 3.0$ mA, $V_{CE} = 1.0$ V
		20	200				$I_C = 8.0$ mA, $V_{CE} = 10$ V
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Notes 4 & 5)	12		15		V	$I_C = 3.0$ mA, $I_B = 0$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)				0.4	V	$I_C = 10$ mA, $I_B = 1.0$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage				1.0	V	$I_C = 10$ mA, $I_B = 1.0$ mA

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle $\leqslant$ 1%.
6. For product family characteristic curves, refer to Curve Set T121.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	3563 MIN	3563 MAX	MPS918 MIN	MPS918 MAX	UNITS	TEST CONDITIONS
C_{ob}	Output Capacitance		1.7		1.7 3.0	pF pF	V_{CB} = 10 V, I_E = 0, f = 1.0 MHz V_{CB} = 0, I_E = 0, f = 1.0 MHz
C_{ib}	Input Capacitance				2.0	pF	V_{EB} = 0.5 V, I_C = 0, f = 1.0 MHz
h_{fe}	High Frequency Current Gain	 6.0	 15	6.0			I_C = 4.0 mA, V_{CE} = 10 V, f = 100 MHz I_C = 8.0 mA, V_{CE} = 10 V, f = 100 MHz
h_{fe}	Small Signal Current Gain	20	250				I_C = 8.0 mA, V_{CE} = 10 V, f = 1.0 kHz
G_{pe}	Available Power Gain (neutralized) (test circuit 254 for MPS918, PN/MPS3563)	 14	 26	15		dB dB	I_C = 6.0 mA, V_{CB} = 12 V, f = 200 MHz I_C = 8.0 mA, V_{CE} = 10 V, f = 200 MHz
P_O	Power Output (test circuit no. 264)			30		mW	I_C = 8.0 mA, V_{CB} = 15 V, f = 500 MHz
η	Collector Efficiency			25		%	I_C = 8.0 mA, V_{CB} = 15 V, f = 500 MHz
$r_b'C_c$	Collector to Base Time Constant	8.0	25			pF	I_C = 8.0 mA, V_{CB} = 10 V, f = 79.8 MHz
NF	Noise Figure				6.0	dB	I_C = 1.0 mA, V_{CE} = 6.0 V, f = 60 kHz, R_G = 400 Ω

SYMBOL	CHARACTERISTIC	PN918 MIN	PN918 MAX	UNITS	TEST CONDITIONS
BV_{CBO}	Collector to Base Breakdown Voltage	30		V	I_C = 10 μA, I_E = 0
BV_{EBO}	Emitter to Base Breakdown Voltage	3.0		V	I_E = 10 μA, I_C = 0
I_{CBO}	Collector Cutoff Current		10 1.0	nA μA	V_{CB} = 15 V, I_E = 0 V_{CB} = 15 V, I_E = 0, T_A = 150° C
h_{FE}	DC Current Gain (Note 5)	20			I_C = 3.0 mA, V_{CE} = 1.0 V
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Notes 4 & 5)	15		V	I_C = 3.0 mA, I_B = 0
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.4	V	I_C = 10 mA, I_B = 1.0 mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage		1.0	V	I_C = 10 mA, I_B = 1.0 mA
C_{ob}	Output Capacitance		1.7 3.0	pF pF	V_{CB} = 10 V, I_E = 0, f = 1.0 MHz V_{CB} = 0, I_E = 0, f = 1.0 MHz
C_{ib}	Input Capacitance		1.6	pF	V_{EB} = 0.5 V, I_C = 0, f = 1.0 MHz

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	PN918 MIN	PN918 MAX	UNITS	TEST CONDITIONS
h_{fe}	High Frequency Current Gain	6.0			$I_C = 4.0$ mA, $V_{CE} = 10$ V, f = 100 MHz
G_{pe}	Available Power Gain (neutralized) (test circuit 254 for PN918)	15		dB	$I_C = 6.0$ mA, $V_{CB} = 12$ V, f = 200 MHz
P_O	Power Output (test circuit no. 264)	30		mW	$I_C = 8.0$ mA, $V_{CB} = 15$ V, f = 500 MHz
η	Collector Efficiency	25		%	$I_C = 8.0$ mA, $V_{CB} = 15$ V, f = 500 MHz
NF	Noise Figure		6.0	dB	$I_C = 1.0$ mA, $V_{CE} = 6.0$ V, f = 60 kHz, $R_G = 400\ \Omega$

FAIRCHILD

A Schlumberger Company

PN3565/FTSO3565

NPN Low Level High Gain Amplifiers

- V_{CEO} ... **25 V (Min)**
- h_{FE} ... **150-600 @ 1.0 mA**

PACKAGE

PN3565	TO-92
FTSO3565	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Note 2)

Total Dissipation at	PN	FTSO
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 3)	25 V
V_{CBO}	Collector to Base Voltage	30 V
V_{EBO}	Emitter to Base Voltage	6.0 V
I_C	Collector Current	50 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 4)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CBO}	Collector to Base Breakdown Voltage	30		V	$I_C = 100\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	6.0		V	$I_C = 0$, $I_E = 10\ \mu A$
I_{CBO}	Collector Cutoff Current		50	nA	$V_{CB} = 25$ V, $I_E = 0$
I_{CBO}	Collector Cutoff Current		3.0	μA	$V_{CB} = 25$ V, $I_E = 0$, $T_A = 65°$ C
h_{FE}	DC Current Gain	150 70	600		$I_C = 1.0$ mA, $V_{CE} = 10$ V $I_C = 100\ \mu A$, $V_{CE} = 10$ V
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage	25		V	$I_C = 2.0$ mA, $I_B = 0$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage		0.35	V	$I_C = 1.0$ mA, $I_B = 0.1$ mA
C_{ob}	Open Circuit Output Capacitance		40	pF	$I_E = 0$, $V_{CB} = 5.0$ V, f = 140 kHz
h_{fe}	High Frequency Current Gain	2.0	12		$I_C = 1.0$ mA, $V_{CE} = 5.0$ V, f = 20 MHz
h_{ie}	Input Resistance	2.0	20	kΩ	$I_C = 1.0$ mA, $V_{CE} = 5.0$ V, f = 1.0 kHz
h_{oe}	Output Conductance	0.5	100	μmhos	$I_C = 1.0$ mA, $V_{CE} = 5.0$ V, f = 1.0 kHz
h_{fe}	Small Signal Current Gain	120	750		$I_C = 1.0$ mA, $V_{CE} = 5.0$ V, f = 1.0 kHz

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These ratings give a maximum junction temperature of 150° C and (TO92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
3. Rating refers to a high current point where collector to emitter voltage is lowest.
4. For product family characteristic curves, refer to Curve Set T155.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

FAIRCHILD

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PN3566/FTSO3566

NPN Small Signal General Purpose Amplifiers

- **V_{CEO} ... 30 V (Min)**
- **h_{FE} ... 150-600 @ 10 mA**
- **Complement ... MPS3638A**

PACKAGE

PN3566	TO-92
FTSO3566	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	PN	FTSO
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	30 V
V_{CBO}	Collector to Base Voltage	40 V
V_{EBO}	Emitter to Base Voltage	5.0 V
I_C	Collector Current	200 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CBO}	Collector to Base Breakdown Voltage	40		V	$I_C = 100\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0		V	$I_E = 10\ \mu A$, $I_C = 0$
I_{CBO}	Collector Cutoff Current		50	nA	$V_{CB} = 20$ V, $I_E = 0$
I_{CBO}	Collector Cutoff Current		5.0	μA	$V_{CB} = 20$ V, $I_E = 0$, $T_A = 75°$ C
I_{EBO}	Emitter Cutoff Current		10	μA	$V_{EB} = 5.0$ V, $I_C = 0$
h_{FE}	DC Pulse Current Gain (Note 5)	150 80	600		$I_C = 10$ mA, $V_{CE} = 10$ V $I_C = 2.0$ mA, $V_{CE} = 10$ V

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle $\leq$ 1%.
6. For product family characteristic curves, refer to Curve Set T145.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Pulsed) (Note 5)		1.0	V	$I_C = 100$ mA, $I_B = 10$ mA
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Notes 4 & 5)	30		V	$I_C = 30$ mA, $I_B = 0$ (pulsed)
$V_{BE(ON)}$	Base to Emitter "On" Voltage (pulsed) (Note 5)		0.9	V	$I_C = 100$ mA, $V_{CE} = 1.0$ V
C_{ob}	Output Capacitance		25	pF	$V_{CB} = 10$ V, $I_E = 0$, f = 140 kHz
h_{fe}	High Frequency Current Gain	2.0	35		$I_C = 30$ mA, $V_{CE} = 10$ V, f = 20 MHz

FAIRCHILD

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PN3567/FTSO3567
PN3569/FTSO3569

NPN Small Signal General Purpose Amplifiers

- **V_{CEO} ... 40 V (Min)**
- **h_{FE} ... 100-300 @ 10 mA (3569); 40-120 @ 150 mA (3567)**
- **Complement ... MPS4355**

PACKAGE

PN3567	TO-92
PN3569	TO-92
FTSO3567	TO-236AA/AB
FTSO3569	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	PN	FTSO
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Notes 4 & 6)	40 V
V_{CBO}	Collector to Base Voltage	80 V
V_{EBO}	Emitter to Base Voltage	5.0 V
I_C	Collector Current	500 mA
I_B	Base Current	100 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 7)

SYMBOL	CHARACTERISTIC	3567 MIN	3567 MAX	3569 MIN	3569 MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage (Note 5)	40		40		V	$I_C = 30$ mA, $I_B = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	80		80		V	$I_C = 100\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0		5.0		V	$I_E = 10\ \mu A$, $I_C = 0$
I_{CBO}	Collector Cutoff Current		50 5.0		50 5.0	nA μA	$V_{CB} = 40$ V, $I_E = 0$ $V_{CB} = 40$ V, $I_E = 0$, $T_A = 75°$ C
I_{EBO}	Emitter Cutoff Current		25		25	nA	$V_{EB} = 4.0$ V, $I_C = 0$

NOTES:
1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. Applicable 0 to 30 mA.
7. For product family characteristic curves, refer to Curve Set T145.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 7)

SYMBOL	CHARACTERISTIC	3567 MIN	3567 MAX	3569 MIN	3569 MAX	UNITS	TEST CONDITIONS
h_{FE}	DC Current Gain (Note 5)	40 40	120	100 100	300		$I_C = 150$ mA, $V_{CE} = 1.0$ V $I_C = 30$ mA, $V_{CE} = 1.0$ V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.25		0.25	V	$I_C = 150$ mA, $I_B = 15$ mA
$V_{BE(ON)}$	Base to Emitter "On" Voltage (Note 5)		1.1		1.1	V	$I_C = 150$ mA, $V_{CE} = 1.0$ V
C_{cb}	Collector to Base Capacitance		20		20	pF	$V_{CB} = 10$ V, $I_E = 0$, f = 140 kHz
C_{eb}	Emitter to Base Capacitance		80		80	pF	$V_{EB} = 0.5$ V, $I_C = 0$, f = 140 kHz
$\|h_{fe}\|$	Magnitude of Common Emitter Small Signal Current Gain	3.0	30	3.0	30		$I_C = 50$ mA, $V_{CE} = 10$ V, f = 20 MHz

3

FAIRCHILD

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PN/MPS/FTSO3638
PN/MPS/FTSO3638A

PNP Small Signal General Purpose Amplifiers & Switches

- **V_{CEO} ... −25 V (Min)**
- **h_{FE} ... 30 (Min) (PN/MPS/FTSO3638), 100 (Min) (PN/MPS/FTSO3638A) @ 50 mA**
- **t_{on} ... 75 ns (Max) @ 300 mA; t_{off} ... 170 ns (Max) @ 300 mA**
- **Complements ... PN3641, PN3643**

PACKAGE

PN3638	TO-92
PN3638A	TO-92
MPS3638	TO-92
MPS3638A	TO-92
FTSO3638	TO-236AA/AB
FTSO3638A	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

	PN/MPS	FTSO
Total Dissipation at		
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	−25 V
V_{CBO}	Collector to Base Voltage	−25 V
V_{CES}	Collector to Emitter Voltage	−25 V
V_{EBO}	Emitter to Base Voltage	−4.0 V
I_C	Collector Current (Note 2)	500 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	3638 MIN	3638 MAX	3638A MIN	3638A MAX	UNITS	TEST CONDITIONS
BV_{CES}	Collector to Emitter Breakdown Voltage	−25		−25		V	$I_C = 100\ \mu A$, $V_{BE} = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	−25		−25		V	$I_C = 100\ \mu A$, $V_{BE} = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	|4.0		−4.0		V	$I_E = 100\ \mu A$, $I_C = 0$
I_{CES}	Collector Reverse Current		35 2.0		35 2.0	nA μA	$V_{CE} = -15$ V, $V_{BE} = 0$ $V_{CE} = -15$ V, $V_{BE} = 0$, $T_A = 65°$ C

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T212.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	3638 MIN	3638 MAX	3638A MIN	3638A MAX	UNITS	TEST CONDITIONS
h_{FE}	DC Pulse Current Gain (Note 5) (MPS3638)	20					$I_C = 10$ mA, $V_{CE} = -10$ V
				100			$I_C = 10$ mA, $V_{CE} = -10$ V
				80			$I_C = 1.0$ mA, $V_{CE} = -10$ V
		30		100			$I_C = 50$ mA, $V_{CE} = -1.0$ V
		20		20			$I_C = 300$ mA, $V_{CE} = -2.0$ V
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Notes 4 & 5)	−25		−25		V	$I_C = 10$ mA, $I_B = 0$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Pulsed) (Note 5)		−0.25 −1.0		−0.25 −1.0	V V	$I_C = 50$ mA, $I_B = 2.5$ mA1 $I_C = 300$ mA, $I_B = 30$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)	 −0.8	−1.1 −2.0	 −0.8	−1.1 −2.0	V V	$I_C = 50$ mA, $I_B = 2.5$ mA $I_C = 300$ mA, $I_B = 30$ mA
C_{ob}	Common Base Open Circuit, Output Capacitance		20		10	pF	$V_{CB} = -10$ V, $I_E = 0$, $f = 140$ kHz
C_{ib}	Common Base Open Circuit, Input Capacitance (PN3638A)				35	pF	$V_{EB} = -0.5$ V, $I_C = 0$, $f = 140$ kHz
	(MPS3638A)		65		25	pF	$V_{EB} = -0.5$ V, $I_C = 0$, $f = 140$ kHz
h_{fe}	Magnitude of Small Signal Current Gain	1.0		1.5			$I_C = 50$ mA, $V_{CE} = -3.0$ V, $f = 100$ MHz
h_{fe}	Small Signal Current Gain (PN3638)	25					$I_C = 10$ mA, $V_{CE} = -10$ V, $f = 1.0$ kHz
	(MPS3638)	25	180				$I_C = 10$ mA, $V_{CE} = -10$ V, $f = 1.0$ kHz
				100			$I_C = 10$ mA, $V_{CE} = -10$ V, $f = 1.0$ kHz
h_{ie}	Input Resistance (MPS3638)		2000 1500		2000	Ω Ω	$I_C = 10$ mA, $V_{CE} = 10$ V, $f = 1.0$ kHz
h_{oe}	Output Conductance		1200		1200	μmhos	$I_C = 10$ mA, $V_{CE} = -10$ V, $f = 1.0$ kHz
h_{re}	Voltage Feedback Ratio		2600		1500	$\times 10^{-6}$	$I_C = 10$ mA, $V_{CE} = -10$ V, $f = 1.0$ kHz
t_{on}	Turn On Time (test circuit no. 536)		75		75	ns	$I_C \approx 300$ mA, $I_{B1} \approx 30$ mA, $V_{CC} = 10$ V
t_{off}	Turn Off Time (test circuit no. 536)		170		170	ns	$I_C \approx 300$ mA, $I_{B1} \approx I_{B2} \approx 30$ mA, $V_{CC} = 10$ V

PN/MPS/FTSO3639
PN/MPS/FTSO3640

PNP High Speed Saturated Logic Switches

- V_{CEO} ... **12 V (Min) (PN/MPS3640)**
- t_{on} ... **25 ns (Max) @ 50 mA, 60 ns (Max) @ 10 mA;**
  t_{off} ... **35 ns (Max) @ 50 mA, 75 ns (Max) @ 10 mA**
- **Complements ... PN4274, 2N5769**

PACKAGE

PN3639	TO-92
PN3640	TO-92
MPS3639	TO-92
MPS3640	TO-92
FTSO3639	TO-236AA/AB
FTSO3640	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	PN/MPS	FTSO
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents		**3639**	**3640**
V_{CEO}	Collector to Emitter Voltage (Note 4)	−6 V	−12 V
V_{CBO}	Collector to Base Voltage	−6 V	−12 V
V_{EBO}	Emitter to Base Voltage	−4.0 V	−4.0 V
I_C	Collector Current	80 mA	80 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	PN3639 MIN	PN3639 MAX	PN3640 MIN	PN3640 MAX	UNITS	TEST CONDITIONS
BV_{CES}	Collector to Emitter Breakdown Voltage	−6.0		−12.0		V	$I_C = 100\ \mu A$, $V_{BE} = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	−6.0		−12.0		V	$I_C = 100\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	−4.0		−4.0		V	$I_E = 100\ \mu A$, $I_C = 0$
I_{CES}	Collector Reverse Current		50			nA	$V_{CE} = -3.0$ V, $V_{BE} = 0$
					50	nA	$V_{CE} = -6.0$ V, $V_{BE} = 0$
			1.0			μA	$V_{CE} = -3.0$ V, $V_{BE} = 0$, $T_A = 65°$ C
					1.0	μA	$V_{CE} = -6.0$ V, $V_{BE} = 0$, $T_A = 65°$ C
h_{FE}	DC Pulse Current Gain (Note 5)	30	120	30	120		$I_C = 10$ mA, $V_{CE} = -0.3$ V
		20		20			$I_C = 50$ mA, $V_{CE} = -1.0$ V

NOTES:
1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T292.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	PN3639 MIN	PN3639 MAX	PN3640 MIN	PN3640 MAX	UNITS	TEST CONDITIONS
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Note 5)	−6.0		−12		V	$I_C = 10$ mA, $I_B = 0$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 4)		−0.16 −0.5 −0.25 −0.23		−0.2 −0.6 −0.3 −0.25	V V V V	$I_C = 10$ mA, $I_B = 1.0$ mA $I_C = 50$ mA, $I_B = 5.0$ mA $I_C = 10$ mA, $I_B = 0.5$ mA $I_C = 10$ mA, $I_B = 1.0$ mA, $T_A = 65°$ C
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)	−0.75 −0.8	−0.95 −1.0 1.5	−0.75 −0.8	−0.95 −1.0 1.5	V V V	$I_C = 10$ mA, $I_B = 0.5$ mA $I_C = 10$ mA, $I_B = 1.0$ mA $I_C = 50$ mA, $I_B = 5.0$ mA
C_{ob}	Output Capacitance		3.5 5.5		3.5 5.5	pF pF	$V_{CB} = -5.0$ V, $I_E = 0$, f = 140 kHz $V_{CB} = 0$, $I_E = 0$, f = 140 kHz
C_{ib}	Input Capacitance		3.5		3.5	pF	$V_{EB} = -0.5$ V, $I_C = 0$, f = 140 kHz
h_{fe}	High Frequency Current Gain	3.0 5.0		3.0 5.0			$I_C = 10$ mA, $V_{CB} = 0$, f = 100 MHz $I_C = 10$ mA, $V_{CE} = -5.0$ V, f = 100 MHz
τ_s	Storage Time (test circuit no. 234)		30		50	ns	$I_C \simeq 10$ mA, $I_{B1} \simeq I_{B2} \simeq 10$ mA, $V_{CC} = 3.0$ V
t_{on}	Turn On Time (test circuit no. 235) (test circuit no. 219)		25 60		25 60	ns ns	$I_C \simeq 50$ mA, $I_{B1} \simeq 5.0$ mA, $V_{CC} = 6.0$ V $I_C \simeq 10$ mA, $I_{B1} \simeq 0.5$ mA, $V_{CC} = -1.5$ V
t_{off}	Turn Off Time (test circuit no. 235) (test circuit no. 219)		25 60		35 75	ns ns	$I_C \simeq 50$ mA, $I_{B1} \simeq I_{B2} \simeq 5.0$ mA, $V_{CC} = 6.0$ V $I_C \simeq 10$ mA, $I_{B1} \simeq I_{B2} \simeq 0.5$ mA, $V_{CC} = 1.5$ V

SYMBOL	CHARACTERISTIC	MPS3639 MIN	MPS3639 MAX	MPS3640 MIN	MPS3640 MAX	UNITS	TEST CONDITIONS
BV_{CES}	Collector to Emitter Breakdown Voltage	−6.0		−12.0		V	$I_C = 100\ \mu$A, $V_{BE} = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	−6.0		−12.0		V	$I_C = 100\ \mu$A, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	−4.0		−4.0		V	$I_E = 100\ \mu$A, $I_C = 0$
I_{CES}	Collector Reverse Current		10 1.0 		 10 1.0	nA nA μA μA	$V_{CE} = -3.0$ V, $V_{BE} = 0$ $V_{CE} = -6.0$ V, $V_{BE} = 0$ $V_{CE} = -3.0$ V, $V_{BE} = 0$, $T_A = 65°$ C $V_{CE} = -6.0$ V, $V_{BE} = 0$, $T_A = 65°$ C

3

SYMBOL	CHARACTERISTIC	MPS3639 MIN	MPS3639 MAX	MPS3640 MIN	MPS3640 MAX	UNITS	TEST CONDITIONS
h_{FE}	DC Pulse Current Gain (Note 5)	30 20	120	30 20	120		$I_C = 10$ mA, $V_{CE} = -0.3$ V $I_C = 50$ mA, $V_{CE} = -1.0$ V
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Note 5)	−6.0		−12		V	$I_C = 10$ mA, $I_B = 0$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		−0.16 −0.5 −0.23		−0.2 −0.6 −0.25	V V V	$I_C = 10$ mA, $I_B = 1.0$ mA $I_C = 50$ mA, $I_B = 5.0$ mA $I_C = 10$ mA, $I_B = 1.0$ mA, $T_A = 65°$ C
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)	−0.75 −0.8	−0.95 −1.0 1.5	−0.75 −0.8	−0.95 −1.0 1.5	V V V	$I_C = 10$ mA, $I_B = 0.5$ mA $I_C = 10$ mA, $I_B = 1.0$ mA $I_C = 50$ mA, $I_B = 5.0$ mA
C_{ob}	Output Capacitance		3.5		3.5	pF	$V_{CB} = -5.0$ V, $I_E = 0$, f = 140 kHz
C_{ib}	Input Capacitance		3.5		3.5	pF	$V_{EB} = -0.5$ V, $I_C = 0$, f = 140 kHz
h_{fe}	High Frequency Current Gain	3.0 5.0		 5.0			$I_C = 10$ mA, $V_{CB} = 0$, f = 100 MHz $I_C = 10$ mA, $V_{CE} = -5.0$, f = 100 MHz
t_{on}	Turn On Time (test circuit no. 235) (test circuit no. 219)		25 60		25 60	ns ns	$I_C \simeq 50$ mA, $I_{B1} \simeq 5.0$ mA, $V_{CC} = 6.0$ V $I_C \simeq 10$ mA, $I_{B1} \simeq 0.5$ mA, $V_{CC} = -1.5$ V
t_{off}	Turn Off Time (test circuit no. 235) (test circuit no. 219)		25 60		35 75	ns ns	$I_C \simeq 50$ mA, $I_{B1} \simeq I_{B2} \simeq 5.0$ mA, $V_{CC} = -6.0$ V $I_C \simeq 10$ mA, $I_{B1} \simeq I_{B2} \simeq 0.5$ mA, $V_{CC} = 1.5$ V

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PN3641/FTSO3641
PN3642/FTSO3642
PN3643/FTSO3643

NPN General Purpose Small Signal Amplifiers

- **V_{CEO} ... 30 V (Min) (PN/FTSO3641, PN/FTSO3643), 45 V (Min) (PN/FTSO3642)**
- **h_{FE} ... 100 (Min) @ 150 mA, 25 (Min) @ 500 mA (PN/FTSO3643)**
- **P_G ... 400 mW RF Power Out at 30 MHz**
- **f_T ... 250 MHz (Min) (PN3643)**
- **t_{on} ... 60 ns (Max) @ 300 mA, t_{off} ... 150 ns (Max) @ 300 mA**
- **Complements ... MPS3638/A, PN3644**

PACKAGE

PN3641	TO-92
PN3642	TO-92
PN3643	TO-92
FTSO3641	TO-236AA/AB
FTSO3642	TO-236AA/AB
FTSO3643	TO-236AA/AB

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ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	**PN**	**FTSO**
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents		**3641/3**	**3642**
V_{CEO}	Collector to Emitter Voltage (Note 4)	30 V	45 V
V_{CBO}	Collector to Base Voltage	60 V	60 V
V_{EBO}	Emitter to Base Voltage	5.0 V	5.0 V
I_C	Collector Current	500 mA	500 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	3641 MIN	3641 MAX	3642 MIN	3642 MAX	UNITS	TEST CONDITIONS
$BV_{CEO(sus)}$	Collector to Emitter Breakdown Voltage (Notes 4 & 5)	30		45		V	$I_C = 10$ mA, $I_B = 0$
BV_{CES}	Collector to Emitter Breakdown Voltage	60		60		V	$I_C = 10\ \mu A$, $V_{BE} = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	60		60		V	$I_C = 10\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0		5.0		V	$I_E = 10\ \mu A$, $I_C = 0$

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125°C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T145.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	3641 MIN	3641 MAX	3642 MIN	3642 MAX	UNITS	TEST CONDITIONS
I_{CES}	Collector Cutoff Current (Note 5)		50 1.0		50 1.0	nA μA	$V_{CE} = 50$ V, $V_{BE} = 0$ $V_{CE} = 50$ V, $V_{BE} = 0$, $T_A = 65°$ C
h_{FE}	DC Pulse Current Gain (Note 5)	40 15	120	40 15	120		$I_C = 150$ mA, $V_{CE} = 10$ V $I_C = 500$ mA, $V_{CE} = 10$ V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.22		0.22	V	$I_C = 150$ mA, $I_B = 15$ mA
C_{ob}	Output Capacitance		8.0		8.0	pF	$V_{CB} = 10$ V, $I_E = 0$, f = 140 kHz
h_{fe}	Magnitude of Common Emitter, Short Circuit Small Signal Current Gain	1.5		1.5			$I_C = 50$ mA, $V_{CE} = 5.0$ V, f = 100 MHz
G_{PE}	Amplifier Power Gain (test circuit no. 238)	10		10		dB	(Zero Signal) $V_{CE} = 15$ V, $I_C = 0$, $R_G = 140\ \Omega$, $R_L = 260\ \Omega$, f = 30 MHz, $P_{IN} = 40$ mW
η	Collector Efficiency (test circuit no. 238)	60		60		%	(Zero Signal) $V_{CE} = 15$ V, $I_C = 0$, $R_G = 140\ \Omega$, $R_L = 260\ \Omega$, f = 30 MHz, $P_{IN} = 40$ mW
t_{on}	Turn On Time (test circuit no. 241)		60		60	ns	$I_C \approx 300$ mA, $I_{B1} \approx 30$ mA,
t_{off}	Turn Off Time (test circuit no. 242)		150		150	ns	$I_C \approx 300$ mA, $I_{B1} \approx I_{B2} = 30$ mA

SYMBOL	CHARACTERISTIC	3643 MIN	3643 MAX	UNITS	TEST CONDITIONS
$BV_{CEO(sus)}$	Collector to Emitter Breakdown Voltage (Notes 4 & 5)	30		V	$I_C = 10$ mA, $I_B = 0$
BV_{CES}	Collector to Emitter Breakdown Voltage	60		V	$I_C = 10\ \mu$A, $V_{BE} = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	60		V	$I_C = 10\ \mu$A, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0		V	$I_E = 10\ \mu$A, $I_C = 0$
I_{CES}	Collector Cutoff Current (Note 5)		50 1.0	nA μA	$V_{CE} = 50$ V, $V_{BE} = 0$ $V_{CE} = 50$ V, $V_{BE} = 0$, $T_A = 65°$ C
h_{FE}	DC Pulse Current Gain (Note 5)	100 25	300		$I_C = 150$ mA, $V_{CE} = 10$ V $I_C = 500$ mA, $V_{CE} = 10$ V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.22	V	$I_C = 150$ mA, $I_B = 15$ mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	3643 MIN	3643 MAX	UNITS	TEST CONDITIONS
C_{ob}	Output Capacitance		8.0	pF	$V_{CB} = 10$ V, $I_E = 0$, f = 140 kHz
h_{fe}	Magnitude of Common Emitter, Short Circuit Small Signal Current Gain	2.5			$I_C = 50$ mA, $V_{CE} = 5.0$ V, f = 100 MHz
G_{PE}	Amplifier Power Gain (test circuit no. 238)	10		dB	(Zero Signal) $V_{CE} = 15$ V, $I_C = 0$, $R_G = 140\ \Omega$, $R_L = 260\ \Omega$, f = 30 MHz, $P_{IN} = 40$ mW
η	Collector Efficiency (test circuit no. 238)	60		%	(Zero Signal) $V_{CE} = 15$ V, $I_C = 0$, $R_G = 140\ \Omega$, $R_L = 260\ \Omega$, f = 30 MHz, $P_{IN} = 40$ mW
t_{on}	Turn On Time (test circuit no. 241)		60	ns	$I_C \approx 300$ mA, $I_{B1} \approx 30$ mA,
t_{off}	Turn Off Time (test circuit no. 242)		150	ns	$I_C \approx 300$ mA, $I_{B1} \approx I_{B2} = 30$ mA

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PN3644/FTSO3644
PN3645/FTSO3645

PNP Small Signal General Purpose Amplifiers & Switches

- **V_{CEO} ... -45 V (Min) (PN/FTSO3644), 60 V (Min) (PN/FTSO3645)**
- **h_{FE} ... 80-240 @ 50 mA**
- **t_{on} ... 40 ns (Max) @ 300 mA**
- **t_{off} ... 100 ns (Max) @ 300 mA**
- **Complements ... PN3569**

PACKAGE

PN3644	TO-92
PN3645	TO-92
FTSO3644	TO-236AA/AB
FTSO3645	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	PN	FTSO
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents		**3645**	**3644**
V_{CEO}	Collector to Emitter Voltage (Note 4)	−60 V	−45 V
V_{CBO}	Collector to Base Voltage	−60 V	−45 V
V_{EBO}	Emitter to Base Voltage	−5.0 V	−5.0 V
I_C	Collector Current	500 mA	500 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	3644 MIN	3644 MAX	3645 MIN	3645 MAX	UNITS	TEST CONDITIONS
BV_{CBO}	Collector to Base Breakdown Voltage	−45		−60		V	$I_C = 100\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	−5.0		−5.0		V	$I_E = 10\ \mu A$, $I_C = 0$
I_{CES}	Collector Reverse Current (Note 5)		35			nA	$V_{CE} = -30$ V, $V_{BE} = 0$
					35	nA	$V_{CE} = -50$ V, $V_{BE} = 0$
			2.0			μA	$V_{CE} = -30$ V, $V_{BE} = 0$, $T_A = 65°$ C
					2.0	μA	$V_{CE} = -50$ V, $V_{BE} = 0$, $T_A = 65°$ C
h_{FE}	DC Current Gain	40		40			$I_C = 100\ \mu A$, $V_{CE} = -10$ V
		80		80			$I_C = 1.0$ mA, $V_{CE} = -10$ V

NOTES:
1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T212.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

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ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	3644 MIN	3644 MAX	3645 MIN	3645 MAX	UNITS	TEST CONDITIONS
h_{FE}	DC Pulse Current Gain (Note 5)	100 80 100 20	 240 300 	100 80 100 20	 240 300 		$I_C = 10$ mA, $V_{CE} = -10$ V $I_C = 50$ mA, $V_{CE} = 1.0$ V $I_C = 150$ mA, $V_{CE} = -10$ V $I_C = 300$ mA, $V_{CE} = -2.0$ V
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Pulsed) (Notes 4 & 5)	−45		−60		V	$I_C = 10$ mA, $I_B = 0$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Pulsed) (Note 5)		−0.25 −0.4 −1.0		−0.25 −0.4 −1.0	V V V	$I_C = 50$ mA, $I_B = 2.5$ mA $I_C = 150$ mA, $I_B = 15$ mA $I_C = 300$ mA, $I_B = 30$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Pulsed) (Note 5)	 −0.8	−1.0 −1.3 −2.0	 −0.8	−1.0 −1.3 −2.0	V V V	$I_C = 50$ mA, $I_B = 2.5$ mA $I_C = 150$ mA, $I_B = 15$ mA $I_C = 300$ mA, $I_B = 30$ mA
C_{ob}	Output Capacitance		8.0		8.0	pF	$V_{CB} = -10$ V, $I_E = 0$, f = 140 kHz
C_{ib}	Input Capacitance		35		35	pF	$V_{EB} = -0.5$ V, $I_C = 0$, f = 140 kHz
h_{fe}	High Frequency Current Gain	2.0		2.0			$I_C = 20$ mA, $V_{CE} = -20$ V, f = 100 MHz
t_{on}	Turn On Time (test circuit no. 246)		40		40	ns	$I_C \approx 300$ mA, $I_{B1} \approx 30$ mA, $V_{CC} = -30$ V
t_{off}	Turn Off Time (test circuit no. 246)		100		100	ns	$I_C \approx 300$ mA, $I_{B1} \approx I_{B2} \approx 30$ mA, $V_{CC} = -30$ V

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PN/MPS/FTSO3646
2N/FTSO5772

NPN High Speed Saturated Logic Switches

- V_{CEO} ... **15 V (Min)**
- τ_s ... **18 ns (Max) @ 10 mA**
- t_{on} ... **18 ns (Max) @ 300 mA**
- t_{off} ... **28 ns (Max) @ 300 mA**

PACKAGE

PN3646	TO-92
MPS3646	TO-92
2N5772	TO-92
FTSO3646	TO-236AA/AB
FTSO5772	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	MPS	FTSO
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	15 V
V_{CES}	Collector to Emitter Voltage	40 V
V_{CBO}	Collector to Base Voltage	40 V
V_{EBO}	Emitter to Base Voltage	5.0 V
I_C	Collector Current	200 mA
	Pulse = 10 μs	500 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CES}	Collector to Emitter Breakdown Voltage	40		V	$I_C = 10\ \mu A$, $V_{BE} = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0		V	$I_C = 0$, $I_E = 100\ \mu A$
BV_{CBO}	Collector to Base Breakdown Voltage	40		V	$I_C = 100\ \mu A$, $I_E = 0$
I_{CES}	Collector Reverse Current		0.5	μA	$V_{CE} = 20$ V, $V_{BE} = 0$
h_{FE}	DC Current Gain (Note 5)	30 25 15	120		$I_C = 30$ mA, $V_{CE} = 0.4$ V $I_C = 100$ mA, $V_{CE} = 0.5$ V $I_C = 300$ mA, $V_{CE} = 1.0$ V

NOTES:
1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T162.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Notes 4 & 5)	15		V	$I_C = 10$ mA, $I_B = 0$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.20 0.28 0.5 0.3	V V V V	$I_C = 30$ mA, $I_B = 3.0$ mA $I_C = 100$ mA, $I_B = 10$ mA $I_C = 300$ mA, $I_B = 30$ mA $I_C = 30$ mA, $I_B = 3.0$ mA, $T_A = 65°$ C
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)	0.75	0.95 1.2 1.7	V V V	$I_C = 30$ mA, $I_B = 3.0$ mA $I_C = 100$ mA, $I_B = 10$ mA $I_C = 300$ mA, $I_B = 30$ mA
C_{ob}	Output Capacitance		5.0	pF	$V_{CB} = 5.0$ V, $I_E = 0$, f = 140 kHz
C_{TE}	Emitter Transition Capacitance		8.0	pF	$V_{BE} = 0.5$ V, $I_C = 0$, f = 140 kHz
h_{fe}	High Frequency Current Gain	3.5			$I_C = 30$ mA, $V_{CE} = 10$ V, f = 100 MHz
τ_s	Charge Storage Time Constant (test circuit no. 3111)		18	ns	$I_C \approx I_{B1} \approx -I_{B2} \approx 10$ mA, $V_{CC} = 10$ V
t_{on}	Turn On Time (test circuit no. 233)		18	ns	$I_C \approx 300$ mA, $I_{B1} \approx 30$ mA, $V_{CC} = 10$ V
t_{off}	Turn Off Time (test circuit no. 233)		28	ns	$I_C \approx 300$ mA, $I_{B1} \approx -I_{B2} = 30$ mA, $V_{CC} = 10$ V

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PN3693/FTSO3693
PN3694/FTSO3694

NPN Small Signal General Purpose Amplifiers

- **V_{CEO} ... 45 V (Min)**
- **h_{FE} ... 100-400 (PN/FTSO3694)**
- **A_{PG} ... 55 dB (Typ) @ 455 kHz**
- **G_C ... 20 dB (Typ) from 108 MHz to 10.7 MHz**
- **NF ... 4.0 dB (Typ) @ 1.0 MHz**
- **Complements ... PN4121, PN4122**

PACKAGE

PN3693	TO-92
PN3694	TO-92
FTSO3693	TO-236AA/AB
FTSO3694	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	PN	FTSO
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	45 V
V_{CBO}	Collector to Base Voltage	45 V
V_{EBO}	Emitter to Base Voltage	4.0 V
I_C	Collector Current	30 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	3693 MIN	3693 MAX	3694 MIN	3694 MAX	UNITS	TEST CONDITIONS
BV_{CBO}	Collector to Base Breakdown Voltage	45		45		V	$I_C = 0.1$ mA, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	4.0		4.0		V	$I_E = 100$ μA, $I_C = 0$
I_{EBO}	Emitter Cutoff Current		100		100	μA	$V_{EB} = 4.0$ V, $I_C = 0$
I_{CBO}	Collector Cutoff Current		50 5.0		50 5.0	nA μA	$V_{CB} = 30$ V, $I_E = 0$ $V_{CB} = 30$ V, $I_E = 0$, $T_A = 65°$ C
h_{FE}	DC Pulse Current Gain (Note 5)	40	160	100	400		$I_C = 10$ mA, $V_{CE} = 10$ V
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Note 5)	45		45		V	$I_C = 10$ mA (pulsed), $I_B = 0$

NOTES:
1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T144.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	3693 MIN	3693 MAX	3694 MIN	3694 MAX	UNITS	TEST CONDITIONS
C_{ob}	Output Capacitance	0.5	6.0	0.5	6.0	pF	$V_{CB} = 10$ V, $I_E = 0$, f = 1.0 MHz
h_{fe}	High Frequency Current Gain	2.0	5.0	2.0	5.0		$I_C = 10$ mA, $V_{CE} = 15$ V, f = 100 MHz
$r_b'C_c$	Collector Base Time Constant		55		55	ps	$I_C = 10$ mA, $V_{CE} = 15$ V, f = 80 MHz

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PN4121/FTSO4121
PN4122/FTSO4122

PNP Small Signal General Purpose Amplifiers & Switches

- V_{CEO} ... **40 V (Min)**
- h_{FE} ... **150-300 @ 10 mA (PN/FTSO4122)**
- f_T ... **450 MHz (Min) @ 10 mA (PN/FTSO4122)**
- $r_b'C_c$ ... **50 ps (Max)**
- C_{cb} ... **4.5 pF (Max)**
- **NF ... 6.0 dB (Max) @ 100 MHz**

PACKAGE

PN4121	TO-92
PN4122	TO-92
FTSO4121	TO-236AA/AB
FTSO4122	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	PN	FTSO
25° C Ambient Temperature	0.625 W	0.350 W*
70° C Ambient Temperature	0.400 W	
25° C Case Temperature	1.0 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	−40 V
V_{CBO}	Collector to Base Voltage	−40 V
V_{EBO}	Emitter to Base Voltage	−5.0 V
I_C	Collector Current	100 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	4121 MIN	4121 MAX	4122 MIN	4122 MAX	UNITS	TEST CONDITIONS
BV_{CES}	Collector to Emitter Breakdown Voltage	−40		−40		V	$I_C = 10\ \mu A$, $V_{BE} = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	−40		−40		V	$I_C = 10\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	−5.0		−50.0		V	$I_E = 10\ \mu A$, $I_C = 0$
I_{CES}	Collector Reverse Current		25 25		25 25	nA μA	$V_{CE} = -30$ V, $V_{BE} = 0$ $V_{CE} = -30$ V, $V_{BE} = 0$, $T_A = 65°$ C
h_{FE}	DC Current Gain	40 60		100 150			$I_C = 100\ \mu A$, $V_{CE} = -1.0$ V $I_C = 1.0$ mA, $V_{CE} = -1.0$ V

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T215.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	4121 MIN	4121 MAX	4122 MIN	4122 MAX	UNITS	TEST CONDITIONS
h_{FE}	DC Pulse Current Gain (Note 5)	70 15	200	150 30	300		I_C = 10 mA, V_{CE} = −1.0 V I_C = 50 mA, V_{CE} = −1.0 V
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Note 5)	−40		−40		V	I_C = 10 mA, I_B = 0
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		−0.13 −0.14 −0.3		−0.13 −0.14 −0.3	V V V	I_C = 1.0 mA, I_B = 0.1 mA I_C = 10 mA, I_B = 1.0 mA I_C = 50 mA, I_B = 5.0 mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)	 −0.7	−0.75 −0.9 −1.1	 −0.7	−0.75 −0.9 −1.1	V V V	I_C = 1.0 mA, I_B = 0.1 mA I_C = 10 mA, I_B = 1.0 mA I_C = 50 mA, I_B = 5.0 mA
C_{cb}	Collector to Base Capacitance		4.5		4.5	pF	V_{CB} = −10 V, I_E = 0
C_{ib}	Open Circuit Input Capacitance		8.0		8.0	pF	V_{EB} = −0.5 V, I_C = 0
$\|h_{fe}\|$	Magnitude of Small Signal Current Gain	4.0		4.5			I_C = 10 mA, V_{CE} = −20 V, f = 100 MHz
h_{fe}	Forward Current Transfer Ratio	50	300	150	450		I_C = 1.0 mA, V_{CE} = −10 V, f = 1.0 kHz
h_{ie}	Input Resistance	1.0	8.0	4.0	12	kΩ	I_C = 1.0 mA, V_{CE} = −10 V, f = 1.0 kHz
h_{oe}	Output Conductance	2.0	24	8.0	40	μmho	I_C = 1.0 mA, V_{CE} = −10 V, f = 1.0 kHz
h_{re}	Voltage Feedback Ratio		3.0		4.0	$x10^{-4}$	I_C = 1.0 mA, V_{CE} = −10 V, f = 1.0 kHz1
$r_b'C_c$	Collector to Base Time Constant		50		50	ps	I_C = 10 mA, V_{CE} = −20 V, f = 80 MHz
t_{on}	Turn On Time (test circuit no. 342)		40		40	ns	I_C = 50 mA, I_{B1} = 5.0 mA,
t_{off}	Turn Off Time (see test circuit no. 342)		150		150	ns	I_C = 50 mA, I_{B1} = 5.0 mA, I_{B2} = 5.0 mA
NF	Noise Figure		6.0 4.0		6.0 4.0	dB dB	I_C = 1.0 mA, V_{CE} = −5.0 V, f = 100 MHz, BW = 15 MHz, R_S = 100 Ω I_C = 100 μA, V_{CE} = −5.0 V, BW = 15 MHz, R_S = 1.0 kΩ f = 10 Hz to 10 kHz

FAIRCHILD

A Schlumberger Company

PN4248/FTSO4248
PN4249/FTSO4249
PN4250/FTSO4250
PN4250A/FTSO4250A

PNP Low Level Low Noise Amplifiers

- **V_{CEO} ... 40 V (Min) (PN4248/50); 60 V (Min) (PN4249/50A)**
- **h_{FE} ... 250-700 @ 100 μA (PN4250/50A)**
- **NF ... 2.0 dB (Max) @ 1.0 kHz (PN4250/50A)**
- **Excellent Beta Linearity from 1.0 μA to 50 mA**

PACKAGE

PN4248	TO-92
PN4249	TO-92
PN4250	TO-92
PN4250A	TO-92
FTSO4248	TO-236AA/AB
FTSO4249	TO-236AA/AB
FTSO4250	TO-236AA/AB
FTSO4250A	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	PN	FTSO
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents		**4248/50**	**4249/50A**
V_{CEO}	Collector to Emitter Voltage (Note 4)	−40 V	−60 V
V_{CBO}	Collector to Base Voltage	−40 V	−60 V
V_{CES}	Collector to Emitter Voltage	−40 V	−60 V
V_{EBO}	Emitter to Base Voltage	−5.0 V	−5.0 V

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	4248 MIN	4248 MAX	4249 MIN	4249 MAX	UNITS	TEST CONDITIONS
BV_{CES}	Collector to Emitter Breakdown Voltage	−40		−60		V	$I_E = 10\ \mu A$, $I_C = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	−40		−60		V	$I_C = 10\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	−5.0		−5.0		V	$I_E = 10\ \mu A$, $I_C = 0$
I_{EBO}	Emitter Cutoff Current		20		20	nA	$V_{EB} = -3.0$ V, $I_C = 0$
I_{CBO}	Collector Cutoff Current		10 3.0		10 3.0	nA μA	$V_{CB} = -40$ V, $I_E = 0$ $V_{CB} = -40$ V, $I_E = 0$, $T_A = 65°$ C
h_{FE}	DC Current Gain	50 50		100 100	300		$I_C = 100\ \mu A$, $V_{CE} = -5.0$ V $I_C = 1.0$ mA, $V_{CE} = -5.0$ V
h_{FE}	DC Pulse Current Gain (Note 5)	50		100			$I_C = 10$ mA, $V_{CE} = -5.0$ V

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T219.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	4248 MIN	4248 MAX	4249 MIN	4249 MAX	UNITS	TEST CONDITIONS
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Note 5)	−40		−60		V	I_C = 5.0 mA (pulsed), I_B = 0
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		−0.25		−0.25	V	I_C = 10 mA, I_B = 0.5 mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)		−0.9		−0.9	V	I_C = 10 mA, I_B = 0.5 mA
C_{ob}	Output Capacitance		6.0		6.0	pF	V_{CB} = −5.0 V, I_E = 0, f = 1.0 MHz
C_{ib}	Input Capacitance		16		16	pF	V_{BE} = −0.5 V, I_C = 0, f = 1.0 MHz
h_{fe}	High Frequency Current Gain	2.0		2.0			I_C = 0.5 mA, V_{CE} = −5.0 V, f = 20 MHz
h_{fe}	Small Signal Current Gain	50	1000	100	550		I_C = 1.0 mA, V_{CE} = −5.0 V, f = 1.0 kHz
h_{ie}	Input Resistance			2.5	17	kΩ	I_C = 1.0 mA, V_{CE} = −5.0 V, f = 1.0 kHz
h_{oe}	Output Conductance			5.0	40	μmhos	I_C = 1.0 mA, V_{CE} = −5.0 V, f = 1.0 kHz
h_{re}	Voltage Feedback Ratio				10	$\times 10^{-4}$	I_C = 1.0 mA, V_{CE} = −5.0 V, f = 1.0 kHz
NF	Wide Band Noise Figure				3.0	dB	I_C = 20 μA, V_{CE} = −5.0 V, f = 10 Hz to 10 kHz, R_S = 10 kΩ PBW = 15.7 kHz
NF	Narrow Band Noise Figure				3.0	dB	I_C = 20 μA, V_{CE} = −5.0 V, f = 1.0 kHz, R_S = 10 kΩ PBW = 150 Hz
					3.0	dB	I_C = 250 μA, V_{CE} = −5.0 V, f = 1.0 kHz, R_S = 1.0 Ω PBW = 150 Hz

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	4250 MIN	4250 MAX	4250A MIN	4250A MAX	UNITS	TEST CONDITIONS
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Note 5)	−40		−60		V	I_C = 5.0 mA (pulsed), I_B = 0
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		−0.25		−0.25	V	I_C = 10 mA, I_B = 0.5 mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)		−0.9			V	I_C = 10 mA, I_B = 0.5 mA
C_{ob}	Output Capacitance		6.0		6.0	pF	V_{CB} = −5.0 V, I_E = 0, f = 1.0 MHz
C_{ib}	Input Capacitance		16			pF	V_{BE} = −0.5 V, I_C = 0, f = 1.0 MHz
h_{fe}	High Frequency Current Gain	2.5					I_C = 0.5 mA, V_{CE} = −5.0 V, f = 20 MHz
h_{fe}	Small Signal Current Gain	250	800	250	800		I_C = 1.0 mA, V_{CE} = −5.0 V, f = 1.0 kHz
h_{ie}	Input Resistance	6.0	20	6.0	20	kΩ	I_C = 1.0 mA, V_{CE} = −5.0 V, f = 1.0 kHz
h_{oe}	Output Conductance	5.0	50	5.0	50	μmhos	I_C = 1.0 mA, V_{CE} = −5.0 V, f = 1.0 kHz
h_{re}	Voltage Feedback Ratio		10		10	$x10^{-4}$	I_C = 1.0 mA, V_{CE} = −5.0 V, f = 1.0 kHz
NF	Wide Band Noise Figure		2.0		2.0	dB	I_C = 20 μA, V_{CE} = −5.0 V, f = 10 Hz to 10 kHz, R_S = 10 kΩ PBW = 15.7 kHz
NF	Narrow Band Noise Figure		2.0 2.0		2.0 2.0	dB dB	I_C = 20 μA, V_{CE} = −5.0 V, f = 1.0 kHz, R_S = 10 kΩ PBW = 150 Hz I_C = 250 μA, V_{CE} = −5.0 V, f = 1.0 kHz, R_S = 1.0 kΩ PBW = 150 Hz
BV_{CES}	Collector to Emitter Breakdown Voltage	−40		−60		V	I_E = 10 μA, I_C = 0
BV_{CBO}	Collector to Base Breakdown Voltage	−40		−60		V	I_C = 10 μA, I_E = 0
BV_{EBO}	Emitter to Base Breakdown Voltage	−5.0		−5.0		V	I_E = 10 μA, I_C = 0
I_{EBO}	Emitter Cutoff Current		20		20	nA	V_{EB} = −3.0 V, I_C = 0
I_{CBO}	Collector Cutoff Current		10 3.0		 10	nA nA μA	V_{CB} = −40 V, I_E = 0 V_{CB} = −50 V, I_E = 0 V_{CB} = −40 V, I_E = 0, T_A = 65° C
h_{FE}	DC Current Gain	250 250	700	250	700		I_C = 100 μA, V_{CE} = −5.0 V I_C = 1.0 mA, V_{CE} = −5.0 V
h_{FE}	DC Pulse Current Gain (Note 5)	250					I_C = 10 mA, V_{CE} = −5.0 V

FAIRCHILD
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PN4258/FTSO4258

PNP Small Signal Ultra High Speed Logic Switch

- V_{CEO} ... **12 V (Min)**
- h_{FE} ... **30-120 @ 10 mA**
- t_{on} ... **15 ns (Max) @ 10 mA**
- **Complement ... 2N/FTSO5769**

PACKAGE

PN4258	TO-92
FTSO4258	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	PN	FTSO
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	-12 V
V_{CBO}	Collector to Base Voltage	−12 V
V_{EBO}	Emitter to Base Voltage	−4.5 V
I_C	Collector Current	50 mA

3

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CBO}	Collector to Base Breakdown Voltage	−12		V	$I_C = 100\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	−4.5		V	$I_E = 100\ \mu A$, $I_C = 0$
BV_{CES}	Collector to Emitter Breakdown Voltage	−12		V	$I_C = 100\ \mu A$, $V_{CE} = 0$
I_{CES}	Collector Reverse Current		10 5.0	nA μA	$V_{CE} = -6.0$ V, $V_{BE} = 0$ $V_{CE} = -6.0$ V, $V_{BE} = 0$, $T_A = 65°$ C
h_{FE}	DC Current Gain (Note 5)	30 15 30	120		$I_C = 10$ mA, $V_{CE} = -3.0$ V $I_C = 1.0$ mA, $V_{CE} = -0.5$ V $I_C = 50$ mA, $V_{CE} = -1.0$ V

NOTES:
1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T292.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		−0.15 −0.5	V V	$I_C = 10$ mA, $I_B = 1.0$ mA $I_C = 50$ mA, $I_B = 5.0$ mA
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Notes 4 & 5)	−12		V	$I_C = 3.0$ mA, $I_B = 0$
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)	−0.75	−0.95 −1.5	V V	$I_C = 10$ mA, $I_B = 1.0$ mA $I_C = 50$ mA, $I_B = 5.0$ mA
C_{cb}	Collector to Base Capacitance		3.0	pF	$V_{CB} = -5.0$ V, $I_E = 0$
C_{ib}	Input Capacitance		3.5	pF	$V_{EB} = -5.0$ V, $I_C = 0$
$\|h_{fe}\|$	Magnitude of Small Signal Current Gain	7.0 5.0			$I_C = 10$ mA, $V_{CE} = -10$ V, f = 100 MHz $I_C = 10$ mA, $V_{CE} = -5.0$ V, f = 100 MHz
t_{on}	Turn On Time (test circuit no. 348)		15	ns	$I_C \approx 10$ mA, $I_{B1} \approx 1.0$ mA
t_{off}	Turn Off Time (test circuit no. 348)		20	ns	$I_C \approx 10$ mA, $I_{B1} \approx -I_{B2} \approx 1.0$ mA
τ_s	Charge Storage Time (test circuit no. 234)		20	ns	$I_C \approx 10$ mA, $I_{B1} \approx -I_{B2} \approx 10$ mA

FAIRCHILD
A Schlumberger Company

PN4274/FTSO4274
PN4275/FTSO4275

NPN Small Signal High Speed Saturated Switches

- **V_{CEO} ... 12 V (Min) (PN/FTSO4274), 15 V (Min) (PN/FTSO4275)**
- **$V_{CE(sat)}$ ... 0.2 V (Max) @ 10 mA**
- **f_T ... 400 MHz (Min)**
- **C_{cb} ... 4.0 pF (Max) @ 5.0 V**
- **τ_s ... 13 ns (Max) @ 10 mA**
- **t_{on} and t_{off} ... 12 ns (Max) @ 10 mA**
- **Complement ... PN3640**

PACKAGE

PN4274	TO-92
PN4275	TO-92
FTSO4274	TO-236AA/AB
FTSO4275	TO-236AA/AB

3

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	**PN**	**FTSO**
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents		**4274**	**4275**
V_{CEO}	Collector to Emitter Voltage (Note 4)	12 V	15 V
V_{CBO}	Collector to Base Voltage	30 V	40 V
V_{CES}	Collector to Emitter Voltage	30 V	40 V
V_{EBO}	Emitter to Base Voltage	4.5 V	4.5 V
I_C	Collector Current (10 μs pulse)	500 mA	500 mA
I_C	Collector Current	100 mA	100 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	4274 MIN	4274 MAX	4275 MIN	4275 MAX	UNITS	TEST CONDITIONS
BV_{CES}	Collector to Emitter Breakdown Voltage	30		40		V	$I_C = 10\ \mu A$, $V_{BE} = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	30		40		V	$I_C = 10\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	4.5		4.5		V	$I_E = 10\ \mu A$, $I_C = 0$

NOTES:
1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T162.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	4274 MIN	4274 MAX	4275 MIN	4275 MAX	UNITS	TEST CONDITIONS
I_{CBO}	Collector Cutoff Current		10		10	μA	$V_{CB} = 20$ V, $I_E = 0$, $T_A = 65°$ C
I_{CES}	Collector Reverse Current		400		400	nA	$V_{CE} = 20$ V, $V_{BE} = 0$
h_{FE}	DC Pulse Current Gain	35 30 18	120	35 30 18	120		$I_C = 10$ mA, $V_{CE} = 1.0$ V $I_C = 30$ mA, $V_{CE} = 0.4$ V $I_C = 100$ mA, $V_{CE} = 1.0$ V
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Note 5)	12		15		V	$I_C = 10$ mA (pulsed), $I_B = 0$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.20 0.18 0.25 0.50 0.30		0.20 0.18 0.25 0.50 0.30	V V V V V	$I_C = 10$ mA, $I_B = 1.0$ mA $I_C = 10$ mA, $I_B = 3.3$ mA $I_C = 30$ mA, $I_B = 3.0$ mA $I_C = 100$ mA, $I_B = 10$ mA $I_C = 10$ mA, $I_B = 1.0$ mA, $T_A = 65°$ C
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)	0.72 0.74	0.85 1.00 1.15 1.60	0.72 0.74	0.85 1.00 1.15 1.60	V V V V	$I_C = 10$ mA, $I_B = 1.0$ mA $I_C = 10$ mA, $I_B = 3.3$ mA $I_C = 30$ mA, $I_B = 3.0$ mA $I_C = 100$ mA, $I_B = 10$ mA
C_{cb}	Collector to Base Capacitance		4.0		4.0	pF	$V_{CB} = 5.0$ V, $I_E = 0$
h_{fe}	High Frequency Current Gain	4.0		4.0			$I_C = 10$ mA, $V_{CE} = 10$ V, f = 100 MHz
τ_s	Charge Storage Time Constant (test circuit no. 3111)		13		13	ns	$I_C = I_{B1} = -I_{B2} = 10$ mA,
t_{on}	Turn On Time (test circuit no. 381)		12		12	ns	$I_C = 10$ mA, $I_{B1} = 3.3$ mA
t_{off}	Turn Off Time (test circuit no. 381)		12		12	ns	$I_C = 10$ mA, $I_{B1} = I_{B2} = 3.3$ mA

FAIRCHILD

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PN4354/FTSO4354
PN4355/MPS4355/FTSO4355
PN4356/MPS4356/FTSO4356

PNP General Purpose Amplifiers

- V_{CEO} ... -60 V (Min) (PN4354, PN/MPS4355), -80 V (Min) (PN/MPS4356)
- $V_{CE(sat)}$ ... -1.0 V (Max) @ I_C = 1.0 A (PN/MPS4355)
- NF ... 3.0 dB (Max) at 1.0 kHz
- Complements ... PN3567, PN3569

PACKAGE

PN4354	TO-92
PN4355	TO-92
PN4356	TO-92
MPS4355	TO-92
MPS4356	TO-92
FTSO4354	TO-236AA/AB
FTSO4355	TO-236AA/AB
FTSO4356	TO-236AA/AB

3

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	PN/MPS	FTSO
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents		4354/5	4356
V_{CEO}	Collector to Emitter Voltage (Note 4)	−60 V	−80 V
V_{CBO}	Collector to Base Voltage	−60 V	−80 V
V_{EBO}	Emitter to Base Voltage	−5.0 V	−5.0 V
I_C	Collector Current	500 mA	500 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	4354 MIN	4354 MAX	4355 MIN	4355 MAX	UNITS	TEST CONDITIONS
BV_{CBO}	Collector to Base Breakdown Voltage	−60		−60		V	$I_C = 10\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	−5.0		−5.0		V	$I_E = 10\ \mu A$, $I_C = 0$
I_{EBO}	Emitter Cutoff Current		100		100	nA	$V_{EB} = -4.0$ V, $I_C = 0$
I_{CBO}	Collector Cutoff Current		50 5.0		50 5.0	nA μA	$V_{CB} = -50$ V, $I_E = 0$ $V_{CB} = -50$ V, $I_E = 0$, $T_A = 75°$ C
h_{FE}	DC Pulse Current Gain (Note 5)	25 40 50 40 30	 500	60 75 100 75 75	 400		$I_C = 100\ \mu A$, $V_{CE} = -10$ V $I_C = 1.0$ mA, $V_{CE} = -10$ V $I_C = 10$ mA, $V_{CE} = -10$ V $I_C = 100$ mA, $V_{CE} = -10$ V $I_C = 500$ mA, $V_{CE} = -10$ V

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T224.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	4354 MIN	4354 MAX	4355 MIN	4355 MAX	UNITS	TEST CONDITIONS
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Note 5)	−60		−60		V	I_C = 10 mA (pulsed), I_B = 0
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		−0.15 −0.5		−0.15 −0.5 −1.0	V V V	I_C = 150 mA, I_B = 15 mA I_C = 500 mA, I_B = 50 mA I_C = 1.0 mA, I_B = 100 mA
$V_{BE(ON)}$	Base to Emitter "On" Voltage (Note 3)		−1.1		−1.1 −1.2	V V	I_C = 500 mA, V_{CE} = −0.5 V I_C = 1.0 A, V_{CE} = −1.0 V
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)		−0.9 −1.1		−0.9 −1.1 −1.2	V V V	I_C = 150 mA, I_B = 15 V I_C = 500 mA, I_B = 500 mA I_C = 1.0 A, I_B = 100 mA
C_{cb}	Collector to Base Capacitance		30		30	pF	V_{CB} = −10 V, I_E = 0, f = 1.0 MHz
C_{eb}	Emitter to Base Capacitance		110		110	pF	V_{BE} = −0.5 V, I_C = 0, f = 1.0 MHz
$\|h_{fe}\|$	Magnitude of Common Emitter Small Signal Current Gain	1.0	5.0	1.0	5.0		I_C = 50 mA, V_{CE} = −10 V, f = 100 MHz
t_{on}	Turn On Time (test circuit no. 341)		100		100	ns	$I_C \approx$ 500 mA, $I_{B1} \approx$ 50 mA, V_{CC} = −30 V
t_{off}	Turn Off Time (test circuit no. 341)		400		400	ns	$I_C \approx$ 500 mA, $I_{B1} \approx I_{B2}$ = 50 mA, V_{CC} = −30 V
NF	Noise Figure		3.0		3.0	dB	I_C = 100 μA, V_{CE} = −10 V, f = 1.0 kHz, BW = 1.0 Hz, R_S = 1.0 kΩ

SYMBOL	CHARACTERISTIC	4356 MIN	4356 MAX	UNITS	TEST CONDITIONS
BV_{CBO}	Collector to Base Breakdown Voltage	−60		V	I_C = 10 μA, I_E = 0
BV_{EBO}	Emitter to Base Breakdown Voltage	−5.0		V	I_E = 10 μA, I_C = 0
I_{EBO}	Emitter Cutoff Current		100	nA	V_{EB} = −4.0 V, I_C = 0
I_{CBO}	Collector Cutoff Current		50 5.0	nA μA	V_{CB} = −50 V, I_E = 0 V_{CB} = −50 V, I_E = 0, T_A = 75° C
h_{FE}	DC Pulse Current Gain (Note 5)	25 40 50 40 30	 250 		I_C = 100 μA, V_{CE} = −10 V I_C = 1.0 mA, V_{CE} = −10 V I_C = 10 mA, V_{CE} = −10 V I_C = 100 mA, V_{CE} = −10 V I_C = 500 mA, V_{CE} = −10 V

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	4356 MIN	4356 MAX	UNITS	TEST CONDITIONS
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Note 5)	−80		V	$I_C = 10$ mA (pulsed), $I_B = 0$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		−0.15 −0.5	V V	$I_C = 150$ mA, $I_B = 15$ mA $I_C = 500$ mA, $I_B = 50$ mA
$V_{BE(ON)}$	Base to Emitter "On" Voltage (Note 3)		−1.1	V	$I_C = 500$ mA, $V_{CE} = -0.5$ V
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)		−0.9 1.1	V V	$I_C = 150$ mA, $I_B = 15$ V $I_C = 500$ mA, $I_B = 500$ mA
C_{cb}	Collector to Base Capacitance		30	pF	$V_{CB} = -10$ V, $I_E = 0$, f = 1.0 MHz
C_{eb}	Emitter to Base Capacitance		110	pF	$V_{BE} = -0.5$ V, $I_C = 0$, f = 1.0 MHz
$\lvert h_{fe} \rvert$	Magnitude of Common Emitter Small Signal Current Gain	1.0	5.0		$I_C = 50$ mA, $V_{CE} = -10$ V, f = 100 MHz
t_{on}	Turn On Time (test circuit no. 341)		100	ns	$I_C \approx 500$ mA, $I_{B1} \approx 50$ mA, $V_{CC} = -30$ V
t_{off}	Turn Off Time (test circuit no. 341)		400	ns	$I_C \approx 500$ mA, $I_{B1} \approx I_{B2} = 50$ mA, $V_{CC} = -30$ V
NF	Noise Figure		3.0	dB	$I_C = 100\ \mu$A, $V_{CE} = -10$ V, f = 1.0 kHz, BW = 1.0 Hz, $R_S = 1.0\ k\Omega$

FAIRCHILD

A Schlumberger Company

PN4888/FTSO4888
PN4889/FTSO4889

PNP Low Noise High Voltage Amplifiers

- **V_{CEO} ... 150 V (Min)**
- **h_{FE} ... 80-300 @ 10 mA (PN/FTSO4889)**
- **C_{ob} ... 4.0 pF (Max)**
- **NF ... 3.0 dB (Max) @ 1.0 kHz (PN/FTSO4889)**
- **Excellent Beta Linearity from 10 μA to 50 mA**

PACKAGE

PN4888	TO-92
PN4889	TO-92
FTSO4888	TO-236AA/AB
FTSO4889	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	PN	FTSO
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	−150 V
V_{CBO}	Collector to Base Voltage	−150 V
V_{EBO}	Emitter to Base Voltage	−6.0 V
I_C	Collector Current	100 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	4888 MIN	4888 MAX	4889 MIN	4889 MAX	UNITS	TEST CONDITIONS
BV_{CES}	Collector to Emitter Breakdown Voltage	−150		−150		V	I_C = 100 μA, I_B = 01
BV_{CBO}	Collector to Base Breakdown Voltage	−150		−150		V	I_C = 100 μA, I_E = 0
BV_{EBO}	Emitter to Base Breakdown Voltage	−0.6		−0.6		V	I_E = 10 μA, I_C = 0
I_{EBO}	Emitter Cutoff Current		50		10	nA	V_{EB} = −4.0 V, I_C = 0
I_{CBO}	Collector Cutoff Current		50 2.5		10 0.5	nA μA	V_{CB} = −100 V, I_E = 0 V_{CB} = −100 V, I_E = 0, T_A = 65° C

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T232.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	4888 MIN	4888 MAX	4889 MIN	4889 MAX	UNITS	TEST CONDITIONS
h_{FE}	DC Pulse Current Gain (Note 5)			60			I_C = 100 μA, V_{CE} = −10 V
		30		70			I_C = 1.0 mA, V_{CE} = −10 V
		40	400	80	300		I_C = 10 mA, V_{CE} = −10 V
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage	−150		−150		V	I_C = 2.0 mA, I_B = 0
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Pulsed) (Note 5)		−0.5		−0.5	V	I_C = 10 mA, I_B = 1.0 mA
$V_{BE(ON)}$	Base to Emitter "On" Voltage (Pulsed) (Note 5)		−0.8		−0.7	V	I_C = 1.0 mA, V_{CE} = −10 V
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Pulsed) (Note 5)		−0.9		−0.9	V	I_C = 10 mA, I_B = 1.0 mA
C_{ob}	Output Capacitance		4.0		4.0	pF	V_{CB} = −20 V, I_E = 0, f = 1.0 MHz
C_{ib}	Input Capacitance		30		25	pF	V_{BE} = −0.5 V, I_C = 0, f = 1.0 MHz
h_{fe}	High Frequency Current Gain	1.5	8.0	2.0	8.0		I_C = 1.0 mA, V_{CE} = −10 V, f = 20 MHz
h_{fe}	Common Emmitter Small Signal Current Gain Forward Current Transfer Ratio	30	500	65	400		I_C = 1.0 mA, V_{CE} = −10 V, f = 1.0 kHz
h_{ie}	Small Signal Short Circuit Input Resistance	0.75	20	1.7	12	kΩ	I_C = 1.0 mA, V_{CE} = −10 V, f = 1.0 kHz
h_{oe}	Small Signal Open Circuit Output Conductance	1.4	40	3.0	25	μmhos	I_C = 1.0 mA, V_{CE} = −10 V, f = 1.0 kHz
h_{re}	Small Signal Open Circuit Reverse Voltage Feedback Ratio				5	$\times 10^{-4}$	I_C = 1.0 mA, V_{CE} = −10 V, f = 1.0 kHz
NF	Wide Band Noise Figure				4.0	dB	I_C = 250 μA, V_{CE} = −5.0 V, f = 10 Hz to 10 kHz, R_S = 1.0 kΩ, BW = 15.7 kHz
NF	Narrow Band Noise Figure				10	dB	I_C = 250 μA, V_{CE} = −5.0 V, R_S = 1.0 kΩ, f = 100 Hz, BW = 15 Hz
					3.0	dB	I_C = 30 μA, V_{CE} = −5.0 V, R_S = 1.0 kΩ, f = 1.0 kHz, BW = 150 Hz
					3.0	dB	I_C = 250 μA, V_{CE} = −5.0 V, R_S = 1.0 kΩ, f = 10 kHz, BW = 1.5 kHz
					4.0	dB	I_C = 1.0 mA, V_{CE} = −10 V, R_S = 1.0 kΩ, f = 1.0 MHz, BW = 2.0 kHz

3

FAIRCHILD

A Schlumberger Company

PN4916/FTSO4916
PN4917/FTSO4917

PNP Small Signal General Purpose Amplifiers & Switches

- **V_{CEO} ... 30 V (Min)**
- **h_{FE} ... 150-300 @ 10 mA**
- **f_T ... 450 MHz (Min) @ 10 mA**
- **C_{cb} ... 4.5 pF (Max)**
- **$r_b'C_c$ ... 50 ps (Max)**
- **Complements ... 2N3903, 2N3904**

PACKAGE

PN4916	TO-92
PN4917	TO-92
FTSO4916	TO-236AA/AB
FTSO4917	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	−55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

	PN	FTSO
Total Dissipation at		
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	−30 V
V_{CBO}	Collector to Base Voltage	−30 V
V_{EBO}	Emitter to Base Voltage	−5.0 V
I_C	Collector Current	100 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	4916 MIN	4916 MAX	4917 MIN	4917 MAX	UNITS	TEST CONDITIONS
BV_{CES}	Collector to Emitter Breakdown Voltage	−30		−30		V	$I_C = 10\ \mu A$, $V_{BE} = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	−30		−30		V	$I_C = 10\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	−5.0		−5.0		V	$I_E = 10\ \mu A$, $I_C = 0$
I_{CES}	Collector Reverse Current		25 25		25 25	nA μA	$V_{CE} = -15$ V, $V_{EB} = 0$ $V_{CE} = -15$ V, $V_{EB} = 0$, $T_A = 65°$ C

NOTES:
1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T215.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	4916 MIN	4916 MAX	4917 MIN	4917 MAX	UNITS	TEST CONDITIONS
h_{FE}	DC Current Gain	40 60		100 150			I_C = 100 μA, V_{CE} = −1.0 V I_C = 1.0 mA, V_{CE} = −1.0 V
h_{FE}	DC Pulse Current Gain (Note 5)	70 15	200	150 30	300		I_C = 10 mA, V_{CE} = −1.0 V I_C = 50 mA, V_{CE} = −1.0 V
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Notes 4 & 5)	−30		−30		V	I_C = 10 mA, I_B = 0 (pulsed)
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage		−0.13		−0.13	V	I_C = 1.0 mA, I_B = 0.1 mA
$V_{CE(sat)}$	Pulsed Collector to Emitter Saturation Voltage (Note 5)		−0.14 −0.3		−0.14 −0.3	V V	I_C = 10 mA, I_B = 1.0 mA I_C = 50 mA, I_B = 5.0 mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage		−0.75		−0.75	V	I_C = 1.0 mA, I_B = 0.1 mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Pulsed) (Note 5)	−0.7 −0.75	−0.9 −1.1	−0.7 −0.75	−0.9 −1.1	V V	I_C = 10 mA, I_B = 1.0 mA I_C = 50 mA, I_B = 5.0 mA
C_{cb}	Collector to Base Capacitance		4.5		4.5	pF	V_{CE} = −10 V, I_E = 0
C_{eb}	Emitter to Base Capacitance		8.0		8.0	pF	V_{EB} = −0.5 V, I_C = 0
$\lvert h_{fe} \rvert$	Magnitude of Small Signal Current Gain	4.0		4.5			I_C = 10 mA, V_{CE} = −20 V, f = 100 MHz
$r_b'C_c$	Collector to Base Time Constant		50		50	ps	I_C = 10 mA, V_{CE} = −20 V, f = 80 MHz
t_{on}	Turn On Time (test circuit no. 407)		40		40	ns	I_C = 50 mA, I_{B1} = 5.0 mA,
t_{off}	Turn Off Time (test circuit no. 407)		150		150	ns	I_C = 50 mA, I_{B1} = 5.0 mA,
NF	Noise Figure		6.0 4.0		6.0 4.0	dB dB	I_C = 1.0 mA, V_{CE} = −5.0 V, R_S = 100 kΩ, BW = 15 MHz, f = 100 MHz I_C = 100 μA, V_{CE} = −5.0 V, R_S = 1.0 kΩ, BW = 15.7 kHz, 3.0 dB Pts **A** 10 Hz & 10 kHz

3

FAIRCHILD
A Schlumberger Company

PN5128/FTSO5128

NPN Small Signal General Purpose Amplifiers & Switches

- **h_{FE} ... 35 (Min) @ 50 mA, 20 (Min) @ 10 mA**
- **f_T ... 150 MHz (Min) @ 50 mA**
- **t_{on} ... 14 ns (Typ) @ 300 mA, t_{off} ... 80 ns (Typ) @ 300 mA**
- **$V_{CE(sat)}$ ... -0.25 V (Max) @ 150 mA, -0.35 V (Typ) @ 500 mA**

PACKAGE

PN5128	TO-92
FTSO5128	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	PN	FTSO
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	12 V
V_{CBO}	Collector to Base Voltage	15 V
V_{EBO}	Emitter to Base Voltage	3.0 V

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CBO}	Collector to Base Breakdown Voltage	15		V	$I_C = 10\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	3.0		V	$I_E = 10\ \mu A$, $I_C = 0$
BV_{CES}	Collector to Emitter Breakdown Voltage	15		V	$I_C = 10\ \mu A$, $I_B = 0$
I_{CBO}	Collector Cutoff Current		50 1.0	nA μA	$V_{CE} = 10$ V, $I_E = 0$ $V_{CE} = 10$ V, $I_E = 0$, $T_A = 65°$ C
I_{EBO}	Emitter Cutoff Current		10	μA	$V_{EB} = 3.0$ V, $I_C = 0$
h_{FE}	DC Pulse Current Gain (Note 5)	20 35	 350		$I_C = 10$ mA, $V_{CE} = 10$ V $I_C = 50$ mA, $V_{CE} = 10$ V

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T145.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.25	V	$I_C = 150$ mA, $I_B = 15$ mA
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Notes 4 & 5)	12		V	$I_C = 10$ mA, $I_B = 0$
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Pulsed) (Note 5)		1.10	V	$I_C = 150$ mA, $I_B = 15$ mA
$V_{BE(ON)}$	Base to Emitter "On" Voltage (Note 5)		1.1	V	$I_C = 150$ mA, $V_{CE} = 5.0$ V
C_{cb}	Collector to Base Capacitance		10	pF	$V_{CB} = 10$ V, $I_E = 0$, f = 1.0 MHz
h_{fe}	High Frequency Current Gain	1.5	8.0		$I_C = 50$ mA, $V_{CE} = 5.0$ V, f = 100 MHz

FAIRCHILD
A Schlumberger Company

PN5130/FTSO5130

NPN Small Signal RF Amplifier & Oscillator

- **G_{pe} . . . 15 dB (Typ) @ 200 MHz**
- **P_O . . . 7.0 mW (Typ) @ 930 MHz**
- **NF . . . 4.0 dB (Typ) @ 60 MHz**

PACKAGE

PN5130	TO-92
FTSO5130	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	**PN**	**FTSO**
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	12 V
V_{CBO}	Collector to Base Voltage	30 V
V_{EBO}	Emitter to Base Voltage	1.0 V
I_C	Collector Current	50 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage	12		V	$I_C = 3.0$ mA, $I_B = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	30		V	$I_C = 100\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	1.0		V	$I_E = 10\ \mu A$, $I_C = 0$
I_{CBO}	Collector Cutoff Current		50 5.0	nA μA	$V_{CB} = 10$ V, $I_C = 0$ $V_{CB} = 10$ V, $I_E = 0$, $T_A = 65°C$
h_{FE}	DC Pulse Current Gain (Note 5)	15	250		$I_C = 8.0$ mA, $V_{CE} = 10$ V

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T121.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.6	V	$I_C = 10$ mA, $I_B = 1.0$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)		1.0	V	$I_C = 10$ mA, $I_B = 1.0$ mA
$V_{BE(ON)}$	Base to Emitter "On" Voltage (Note 5)		1.0	V	$I_C = 10$ mA, $V_{CE} = 10$ V
C_{cb}	Collector to Base Capacitance		1.7	pF	$V_{EB} = 10$ V, $I_E = 0$, f = 1.0 MHz
h_{fe}	Forward Current Transfer Ratio	12	300		$I_C = 8.0$ mA, $V_{CE} = 10$ V, f = 1.0 kHz
$\|h_{fe}\|$	Magnitude of Small Signal Current Gain	4.5			$I_C = 8.0$ mA, $V_{CE} = 10$ V, f = 100 MHz

FAIRCHILD

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PN5133/FTSO5133

NPN Low Level Amplifiers

- h_{FE} ... **60 (Min), 220 (Typ) @ 1.0 mA**
- BV_{CEO} ... **18 V (Min) @ 3.0 mA**

PACKAGE	
PN5133	TO-92
FTSO5133	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	PN	FTSO
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents (Notes 4 & 5)

V_{CEO}	Collector to Emitter Voltage	18 V
V_{CBO}	Collector to Base Voltage	20 V
V_{EBO}	Emitter to Base Voltage	3.0 V

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CBO}	Collector to Base Breakdown Voltage	20		V	$I_C = 100\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	3.0		V	$I_E = 10\ \mu A$, $I_C = 0$
I_{EBO}	Emitter Cutoff Current		50	nA	$V_{EB} = 2.0$ V, $I_C = 0$
I_{CBO}	Collector Cutoff Current		50 5.0	nA μA	$V_{CB} = 15$ V, $I_E = 0$ $V_{CB} = 15$ V, $I_E = 0$, $T_A = 65°$ C
h_{FE}	DC Current Gain	60	1000		$I_C = 1.0$ mA, $V_{CE} = 5.0$ V
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Notes 3 & 4)		18	V	$I_C = 3.0$ mA, $I_B = 0$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage		0.4	V	$I_C = 1.0$ mA, $I_B = 0.1$ mA
$V_{BE(ON)}$	Base to Emitter "On" Voltage		0.75	V	$I_C = 100\ \mu A$, $V_{CE} = 5.0$ V
C_{cb}	Collector to Base Capacitance		5.0	pF	$V_{CB} = 5.0$ V, $I_E = 0$
h_{fe}	High Frequency Current Gain	2.0	20		$I_C = 1.0$ mA, $V_{CE} = 5.0$ V, f = 20 MHz
h_{fe}	Small Signal Current Gain	50	1100		$I_C = 1.0$ mA, $V_{CE} = 5.0$ V, f = 1.0 kHz

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T107.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

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PN5134/FTSO5134

NPN Small Signal High Speed Saturated Switch

- **f_T ... 250 MHz (Min)**
- **C_{cb} ... 4.0 pF (Max) @ 5.0 V**
- **τ_s ... 18 ns (Max) @ 10 mA**
- **t_{on} ... 18 ns (Max) @ 10 mA, t_{off} ... 18 ns (Max) @ 10 mA**
- **Complement ... MPS3639**

PACKAGE

PN5134	TO-92
FTSO5134	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	**PN**	**FTSO**
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	10 V
V_{CES}	Collector to Emitter Voltage	20 V
V_{CBO}	Collector to Base Voltage	20 V
V_{EBO}	Emitter to Base Voltage	3.5 V
I_C	Collector Current	100 mA
	Pulse = 10 μs	500 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CBO}	Collector to Base Breakdown Voltage	20		V	$I_C = 10\ \mu A$, $I_E = 0$
BV_{CES}	Collector to Emitter Breakdown Voltage	20		V	$I_C = 10\ \mu A$, $V_{EB} = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	3.5		V	$I_E = 10\ \mu A$, $I_C = 0$
I_{CBO}	Collector Cutoff Current		10	μA	$V_{CB} = 15$ V, $I_E = 0$, $T_A = 65°C$
I_{CES}	Collector Reverse Current		0.40	μA	$V_{CE} = 15$ V, $V_{EB} = 0$
h_{FE}	DC Current Gain (Note 5)	20 15	150		$I_C = 10$ mA, $V_{CE} = 1.0$ V $I_C = 30$ mA, $V_{CE} = 0.4$ V

NOTES:
1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125°C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T132.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.25 0.20	V V	$I_C = 10$ mA, $I_B = 1.0$ mA $I_C = 10$ mA, $I_B = 3.3$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)	0.70 0.72	0.90 1.10	V V	$I_C = 10$ mA, $I_B = 1.0$ mA $I_C = 10$ mA, $I_B = 3.3$ mA
C_{cb}	Collector to Base Capacitance		4.0	pF	$V_{CB} = 5.0$ V, $I_E = 0$
h_{fe}	High Frequency Current Gain	2.5			$I_C = 10$ mA, $V_{CE} = 10$ V, f = 100 MHz
τ_s	Charge Storage Time Constant (test circuit no. 3111)		18	ns	$I_C = 10$ mA, $I_{B1} \approx -I_{B2} \approx 10$ mA, $V_{CC} = 10$ V
t_{on}	Turn On Time (test circuit no. 381)		18	ns	$I_C \approx 10$ mA, $I_{B1} \approx 3.3$ mA, $V_{CC} = 3.0$ V
t_{off}	Turn Off Time (test circuit no. 381)		7.0	18	ns $I_C \approx 10$ mA, $I_{B1} \approx 3.3$ mA, $I_{B2} \approx -3.3$ mA, $V_{CC} = 2.0$ V

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PN5135/FTSO5135
PN5136/FTSO5136
PN5137/FTSO5137
NPN Small Signal General Purpose Amplifiers

- **P_D ... 625 mW @ T_A = 25° C**
- **V_{CEO} ... 25 V (Min) (PN/FTSO5135)**
- **h_{FE} ... 50-600 @ 10 mA (PN/FTSO5135), 20-400 @ 150 mA (PN/FTSO5136/7)**
- **f_T ... 40 MHz (Min)**
- **Complements ... PN5142, PN5143**

PACKAGE

PN5135	TO-92
PN5136	TO-92
PN5137	TO-92
FTSO5135	TO-236AA/AB
FTSO5136	TO-236AA/AB
FTSO5137	TO-236AA/AB

3

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	**PN**	**FTSO**
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents		**5135**	**5136/7**
V_{CEO}	Collector to Emitter Voltage (Note 4)	25 V	20 V
V_{CBO}	Collector to Base Voltage	30 V	30 V
V_{CES}	Collector to Emitter Voltage	30 V	30 V
V_{EBO}	Emitter to Base Voltage	4.0 V	3.0 V
I_C	Collector Current	200 mA	200 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	5135 MIN	5135 MAX	5136 MIN	5136 MAX	UNITS	TEST CONDITIONS
BV_{CES}	Collector to Emitter Breakdown Voltage	30		30		V	I_C = 100 μA, V_{BE} = 0
BV_{CBO}	Collector to Base Breakdown Voltage	30		30		V	I_C = 100 μA, I_E = 0
BV_{EBO}	Emitter to Base Breakdown Voltage	4.0		3.0		V	I_E = 10 μA, I_C = 0
I_{EBO}	Emitter Cutoff Current				100	nA	V_{EB} = 2.0 V, I_C = 0
			10			μA	V_{EB} = 4.0 V, I_C = 0

NOTES:
1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T145.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

PN5135/FTSO5135
PN5136/FTSO5136
PN5137/FTSO5137

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	5135 MIN	5135 MAX	5136 MIN	5136 MAX	UNITS	TEST CONDITIONS
I_{CBO}	Collector Cutoff Current	300				nA	$V_{CB} = 15$ V, $I_E = 0$
					100	nA	$V_{CB} = 20$ V, $I_E = 0$
			10			μA	$V_{CB} = 15$ V, $I_E = 0$ $T_A = 65°$ C
					10	μA	$V_{CB} = 20$ V, $I_E = 0$, $T_A = 65°$ C
h_{FE}	DC Pulse Current Gain (Note 5)	50	600				$I_C = 10$ mA, $V_{CE} = 10$ V
		15					$I_C = 2.0$ mA, $V_{CE} = 1.0$ V
				20	400		$I_C = 150$ mA, $V_{CE} = 1.0$ V
				20			$I_C = 30$ mA, $V_{CE} = 1.0$ V
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Notes 4 & 5)	25		20		V	$I_C = 1.0$ mA (pulsed), $I_B = 0$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		1.0			V	$I_C = 100$ mA, $I_B = 10$ mA
					0.25	V	$I_C = 150$ mA, $I_B = 15$ mA
$V_{BE(ON)}$	Base to Emitter "On" Voltage (Note 5)		1.0			V	$I_C = 100$ mA, $V_{CE} = 10$ V
					1.1	V	$I_C = 150$ mA, $V_{CE} = 1.0$ V
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)		1.0			V	$I_C = 100$ mA, $I_B = 10$ V
					1.1	V	$I_C = 150$ mA, $I_B = 15$ V
C_{cb}	Collector to Base Capacitance		25		35	pF	$V_{CB} = 10$ V, $I_E = 0$, f = 1.0 MHz
C_{eb}	Emitter to Base Capacitance				85	pF	$V_{EB} = 0.5$ V, $I_C = 0$, f = 1.0 MHz
$\|h_{fe}\|$	Magnitude of Common Emitter Small Signal Current Gain	2.0	15				$I_C = 30$ mA, $V_{CE} = 10$ V, f = 20 MHz
				2.0	20		$I_C = 50$ mA, $V_{CE} = 5.0$ V, f = 20 MHz

SYMBOL	CHARACTERISTIC	5137 MIN	5137 MAX	UNITS	TEST CONDITIONS
BV_{CES}	Collector to Emitter Breakdown Voltage	30		V	$I_C = 100$ μA, $V_{BE} = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	30		V	$I_C = 100$ μA, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	3.0		V	$I_E = 10$ μA, $I_C = 0$
I_{EBO}	Emitter Cutoff Current		100	nA	$V_{EB} = 2.0$ V, $I_C = 0$
I_{CBO}	Collector Cutoff Current		100	nA	$V_{CB} = 20$ V, $I_E = 0$
			10	μA	$V_{CB} = 20$ V, $I_E = 0$, $T_A = 65°$ C
h_{FE}	DC Pulse Current Gain (Note 5)	20	400		$I_C = 150$ mA, $V_{CE} = 1.0$ V
		20			$I_C = 30$ mA, $V_{CE} = 1.0$ V

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	5137 MIN	5137 MAX	UNITS	TEST CONDITIONS
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Notes 4 & 5)	20		V	$I_C = 1.0$ mA (pulsed), $I_B = 0$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.25	V	$I_C = 150$ mA, $I_B = 15$ mA
$V_{BE(ON)}$	Base to Emitter "On" Voltage (Note 5)		1.1	V	$I_C = 150$ mA, $V_{CE} = 1.0$ V
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)		1.1	V	$I_C = 150$ mA, $I_B = 15$ V
C_{cb}	Collector to Base Capacitance		35	pF	$V_{CB} = 10$ V, $I_E = 0$, f = 1.0 MHz
C_{eb}	Emitter to Base Capacitance		85	pF	$V_{BE} = 0.5$ V, $I_C = 0$, f = 1.0 MHz
$\lvert h_{fe} \rvert$	Magnitude of Common Emitter Small Signal Current Gain	2.0	20		$I_C = 50$ mA, $V_{CE} = 5.0$ V, f = 20 MHz

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PN5138/FTSO5138

PNP Low Level Amplifier

- **h_{FE} . . . 50 (Min) @ 100 μA & 10 mA**
- **V_{CEO} . . . −30 V (Min)**

PACKAGE

PN5138	TO-92
FTSO5138	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

	PN	FTSO
Total Dissipation at		
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage	−30 V
V_{CBO}	Collector to Base Voltage	−30 V
V_{EBO}	Emitter to Base Voltage	−5.0 V

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CBO}	Collector to Base Breakdown Voltage	−30		V	I_C = 100 μA, I_E = 0
BV_{EBO}	Emitter to Base Breakdown Voltage	−5.0		V	I_E = 100 μA, I_C = 0
I_{CBO}	Collector Cutoff Current		50 3.0	nA μA	V_{CB} = −20 V, I_E = 0 V_{CB} = −20 V, I_E = 0, T_A = 65° C
h_{FE}	DC Current Gain	50 50	800		I_C = 100 μA, V_{CE} = −10 V I_C = 1.0 mA, V_{CE} = −10 V
h_{FE}	DC Pulse Current Gain (Note 5)	50			I_C = 10 mA, V_{CE} = −10 V
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Notes 4 & 5)	−30		V	I_C = 10 mA (pulsed), I_B = 0

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T219.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		−0.3	V	$I_C = 10$ mA, $I_B = 0.5$ mA
$V_{BE(ON)}$	Base to Emitter "On" Voltage (Note 5)		−1.0	V	$I_C = 10$ mA, $V_{CE} = -10$ V
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)		−1.0	V	$I_C = 10$ mA, $I_B = 0.5$ mA
C_{cb}	Collector to Base Capacitance		7.0	pF	$V_{CB} = -5.0$ V, $I_E = 0$, f = 1.0 MHz
C_{eb}	Emitter to Base Capacitance		30	pF	$V_{EB} = -5.0$ V, $I_C = 0$, f = 1.0 MHz
h_{fe}	High Frequency Current Gain	1.5			$I_C = 0.5$ mA, $V_{CE} = -5.0$ V, f = 20 MHz
h_{fe}	Small Signal Current Gain	40	1000		$I_C = 1.0$ mA, $V_{CE} = -10$ V, f = 1.0 kHz

3

FAIRCHILD
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PN5139/FTSO5139

PNP Small Signal General Purpose Amplifier & Switch

- V_{CEO} . . . **-20 V (Min)**
- h_{FE} . . . **40 (Min) @ 10 mA**
- f_T . . . **300 MHz (Min)**
- C_{cb} . . . **5.0 pF (Max) @ -10 V**

PACKAGE

PN5139	TO-92
FTSO5139	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	PN	FTSO
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	-20 V
V_{CBO}	Collector to Base Voltage	-20 V
V_{EBO}	Emitter to Base Voltage	-5.0 V
I_C	Collector Current	100 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CBO}	Collector to Base Breakdown Voltage	−20		V	$I_C = 100\ \mu A$, $I_E = 0$
BV_{CES}	Collector to Emitter Breakdown Voltage	−20		V	$I_C = 100\ \mu A$, $V_{EB} = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	−5.0		V	$I_E = 100\ \mu A$, $I_C = 0$
I_{CES}	Collector Reverse Current		50 25	nA μA	$V_{CE} = -15$ V, $V_{EB} = 0$ $V_{CE} = -15$ V, $V_{EB} = 0$, $T_A = 65°C$
h_{FE}	DC Current Gain	30 40			$I_C = 100\ \mu A$, $V_{CE} = -10$ V $I_C = 1.0$ mA, $V_{CE} = -10$ V
h_{FE}	DC Pulse Current Gain (Note 5)	40 15			$I_C = 10$ mA, $V_{CE} = -1.0$ V $I_C = 50$ mA, $V_{CE} = -10$ V

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T215.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage		–0.15	V	$I_C = 1.0$ mA, $I_B = 0.1$ mA
$V_{CE(sat)}$	Pulsed Collector to Emitter Saturation Voltage (Note 5)		–0.20 –0.5	V V	$I_C = 10$ mA, $I_B = 1.0$ mA $I_C = 50$ mA, $I_B = 5.0$ mA
$V_{BE(sat)}$	Pulsed Base to Emitter Saturation Voltage (Note 5)	–0.7 –0.75	–1.0 –1.25	V V	$I_C = 10$ mA, $I_B = 1.0$ mA $I_C = 50$ mA, $I_B = 5.0$ mA
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Note 5)	–20		V	$I_C = 10$ mA (pulsed), $I_B = 0$
C_{cb}	Collector to Base Capacitance		5.0	pF	$V_{CB} = -10$ V, $I_E = 0$, f = 1.0 MHz
C_{eb}	Emitter to Base Capacitance		8.0	pF	$V_{EB} = -0.5$ V, $I_C = 0$, f = 1.0 MHz
$\|h_{fe}\|$	Magnitude of Small Signal Current Gain	3.0			$I_C = 10$ mA, $V_{CE} = -20$ V, f = 100 MHz
t_{on}	Turn On Time (test circuit no. 407)		50	ns	$I_C \approx 50$ mA, $I_{B1} \approx 5.0$ mA
t_{off}	Turn Off Time (test circuit no. 407)		200	ns	$I_C \approx 50$ mA, $I_{B1} \approx 5.0$ mA, $I_{B2} \approx -5.0$ mA

FAIRCHILD

A Schlumberger Company

PN5142/FTSO5142
PN5143/FTSO5143

PNP Small Signal General Purpose Amplifiers & Switches

- **V_{CEO} . . . 20 V @ 10 mA**
- **h_{FE} . . . 30 (Min) @ 50 mA, 15 (Min) @ 300 mA**
- **t_{on} . . . 100 ns (Max) @ 300 mA, t_{off} . . . 200 ns (Max) @ 300 mA**

PACKAGE

PN5142	TO-92
PN5143	TO-92
FTSO5142	TO-236AA/AB
FTSO5143	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	PN	FTSO
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	–20 V
V_{CBO}	Collector to Base Voltage	–20 V
V_{EBO}	Emitter to Base Voltage	–4.0 V
I_C	Collector Current	500 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CBO}	Collector to Base Breakdown Voltage	–20		V	$I_C = 100\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	–4.0		V	$I_E = 100\ \mu A$, $I_E = 0$
I_{CES}	Collector Reverse Current		50 2.0	nA µA	$V_{CE} = -12$ V, $V_{BE} = 0$ $V_{CE} = -12$ V, $V_{BE} = 0$, $T_A = 65°$ C
h_{FE}	DC Pulse Current Gain (Note 5)	30 15			$I_C = 50$ mA, $V_{CE} = 1.0$ V $I_C = 300$ mA, $V_{CE} = -10$ V
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Notes 4 & 5)	–20		V	$I_C = 10$ mA (pulsed), $I_B = 0$

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 µs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T212.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (pulsed) (Note 5)		−0.5 −2.0	V V	$I_C = 50$ mA, $I_B = 2.5$ mA $I_C = 300$ mA, $I_B = 30$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (pulsed) (Note 5)	 −0.8	−1.5 −2.5	V V	$I_C = 50$ mA, $I_B = 2.5$ mA $I_C = 300$ mA, $I_B = 30$ mA
C_{cb}	Collector to Base Capacitance		10	pF	$V_{CB} = -10$ V, $I_E = 0$, f = 1.0 MHz
C_{eb}	Emitter to Base Capacitance		30	pF	$V_{EB} = -0.5$ V, $I_C = 0$, f = 1.0 MHz
h_{fe}	High Frequency Current Gain	1.0			$I_C = 50$ mA, $V_{CE} = -3.0$ V, f = 100 MHz
t_{on}	Turn On Time (test circuit no. 245)		100	ns	$I_C \approx 300$ mA, $I_{B1} \approx 30$ mA
t_{off}	Turn Off Time (test circuit no. 245)		200	ns	$I_C \approx 300$ mA, $I_{B1} \approx 30$ mA, $I_{B2} \approx -30$ mA

FAIRCHILD

A Schlumberger Company

PN5770/FTSO5770

NPN Small Signal High Frequency Amplifier & Oscillator

- **P_D . . . 30 mW @ 500 MHz**
- **f_c . . . 800 (Min)**

PACKAGE

PN5770	TO-92
FTSO5770	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	**PN**	**FTSO**
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents

V_{CEO}	Collector-to-Emitter Voltage (Note 4)	15 V
V_{CBO}	Collector-to-Base Voltage	30 V
V_{EBO}	Emitter-to-Base Voltage	4.5 V
I_C	Collector Current	50 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
I_{CBO}	Collector Cutoff Current		10 1.0	nA μA	V_{CB} = 15 V, I_E = 0 V_{CB} = 15 V, I_E = 0, T_A = 125°C
h_{FE}	DC Current Gain (Note 5)	20 50	 200		I_C = 3.0 mA, V_{CE} = 1.0 V I_C = 8.0 mA, V_{CE} = 1.0 V
$V_{CE(sat)}$	Collector-to-Emitter Saturation Voltage		0.4	V	I_C = 10 mA, I_B = 1.0 mA
$V_{BE(sat)}$	Collector to Base Saturation Voltage		1.0	V	I_C = 10 mA, I_B = 1.0 mA

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T121.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
C_{cb}	Collector-to-Base Capacitance	0.7	1.1	pF	V_{CB} = 10 V, f = 1.0 MHz
h_{fe}	Low Frequency Current Gain	40	240		I_C = 8.0 mA, V_{CE} = 20 V, f = 1.0 kHz
h_{fe}	High Frequency Current Gain	8.0	18		I_C = 8.0 mA, V_{CE} = 10 V, f = 100 MHz
$r_b'C_c$	Collector Base Time Constant	3.0	20	ps	I_E = 8.0 mA, V_{CB} = 10 V, f = 79.8 MHz
n	Collector Efficiency	25		%	I_C = 8.0 mA, V_{CB} = 15 V, f = 500 MHz
P_O	Power Output	30		mW	I_C = 8.0 mA, V_{CB} = 15 V, f = 500 MHz

PN5855/FTSO5855
PN5857/FTSO5857

PNP Small Signal General Purpose Transistor

- V_{CEO} ... -60 V and -80 V (Min)
- h_{FE} ... 50 (Min) from 10 mA to 500 mA

PACKAGE

PN5855	TO-92
PN5857	TO-92
FTSO5855	TO-236AA/AB
FTSO5857	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

	PN	FTSO
Total Dissipation at 25° C Ambient Temperature	0.625 W	0.350 W*

Voltages & Currents

(Reverse Voltage Polarity for PNP)		5855	5857
V_{CEO}	Collector to Emitter Voltage	−60 V	−80 V
V_{CBO}	Collector to Base Voltage	−60 V	−80 V
V_{EBO}	Emitter to Base Voltage	−5.0 V	−5.0 V
I_C	Collector Current	1.0 A	1.0 A

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 5)

SYMBOL	CHARACTERISTIC	5855 MIN	5855 MAX	5857 MIN	5857 MAX	UNITS	TEST CONDITIONS
BV_{CBO}	Collector to Base Breakdown Voltage	−60		−80		V	$I_C = 100\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	−5.0		−5.0		V	$I_E = 10\ \mu A$, $I_C = 0$
I_{EBO}	Emitter Cutoff Current		100		100	nA	$V_{EB} = -4.0$ V, $I_C = 0$
I_{CBO}	Collector Cutoff Current		100			nA	$V_{CB} = -40$ V, $I_E = 0$
					100	nA	$V_{CB} = -60$ V, $I_E = 0$
h_{FE}	DC Current Gain (Note 4)	50		50			$I_C = 10$ mA, $V_{CE} = -10$ V
		50	300	50	300		$I_C = 150$ mA, $V_{CE} = -10$ V
		50		50			$I_C = 500$ mA, $V_{CE} = -10$ V
		15		15			$I_C = 1.0$ A, $V_{CE} = -10$ V

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C) for PN5855 and PN5857. These ratings give a maximum junction temperature of 135° C and junction-to-ambient thermal resistance of 150° C/W (derating factor of 6.8 mW/° C) for 2N5855 and 2N5857.
4. Pulse conditions: length = 300 μs; duty cycle = 1%.
5. For product family characteristic curves, refer to Curve Set T224.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 5)

SYMBOL	CHARACTERISTIC	5855 MIN	5855 MAX	5857 MIN	5857 MAX	UNITS	TEST CONDITIONS
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Note 4)	−60		−80		V	$I_C = 10$ mA, $I_B = 0$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 4)		−0.4		−0.4	V	$I_C = 150$ mA, $I_B = 15$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 4)		−1.3		−1.3	V	$I_C = 150$ mA, $I_B = 15$ mA
C_{ob}	Output Capacitance		15		15	pF	$V_{CB} = -10$ V, $I_E = 0$, f = 100 kHz
h_{fe}	High Frequency Current Gain	1.0		1.0			$I_C = 50$ mA, $V_{CE} = -10$ V, f = 100 MHz

3

FAIRCHILD

A Schlumberger Company

PN5965/FTSO5965

Low Power Audio Frequency

- V_{CEO} ... **180 V (Min)**
- h_{FE} ... **50-250 @ 10 mA, 50 (Min) @ 1.0 mA and 50 mA**
- C_{cb} ... **4.0 pF (Max) @ 10 V**
- **Complements ... PN4888**

PACKAGE

PN5965	TO-92
FTSO5965	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	PN	FTSO
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Notes 4 & 5)	180 V
V_{CBO}	Collector to Base Voltage	200 V
V_{EBO}	Emitter to Base Voltage	5.0 V
I_C	DC Collector Current	600 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 7)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage	180		V	$I_C = 1.0$ mA, $I_B = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0		V	$I_C = 0$, $I_E = 10\ \mu A$
BV_{CBO}	Collector to Base Breakdown Voltage	200		V	$I_C = 100\ \mu A$, $I_E = 0$
I_{CBO}	Collector Cutoff Current		50 25	nA µA	$V_{CB} = 160$ V, $I_E = 0$ $V_{CB} = 160$ V, $I_E = 0$, $T_A = 100°$ C
I_{EBO}	Emitter Cutoff Current		50	nA	$V_{EB} = 4.0$ V, $I_C = 0$
h_{FE}	DC Current Gain (Note 5)	50 50 50	 250 		$I_C = 1.0$ mA, $V_{CE} = 5.0$ V $I_C = 10$ mA, $V_{CE} = 5.0$ V $I_C = 50$ mA, $V_{CE} = 5.0$ V

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 µs; duty cycle = 1%.
6. C_{CB} measurement employs a three terminal capacitance bridge incorporating a guard circuit. The emitter terminal shall be connected to the guard terminal of the bridge.
7. For product family characteristic curves, refer to Curve Set T147.

* Package mounted on 99.5% alumina 8mm x 8mm x 0.6mm.

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted) (Note 7)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.15 0.20 0.25	V V V	I_C = 1.0 mA, I_B = 0.1 mA I_C = 10 mA, I_B = 1.0 mA I_C = 50 mA, I_B = 5.0 mA
$V_{BE(ON)}$	Base to Emitter "On" Voltage		0.8	V	I_C = 1.0 mA, V_{CE} = 5.0 V
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)		0.8 1.0 1.0	V V V	I_C = 1.0 mA, I_B = 0.1 V I_C = 10 mA, I_B = 1.0 V I_C = 50 mA, I_B = 5.0 V
C_{cb}	Collector to Base Capacitance (Note 6)		4.0	pF	V_{CB} = 10 V, I_E = 0, f = 1.0 MHz
$\lvert h_{fe} \rvert$	Magnitude of Common Emitter Small Signal Current Gain	1.0	5.0		I_C = 10 mA, V_{CE} = 10 V, f = 100 MHz
h_{fe}	Small Signal Current Gain	50			I_C = 1.0 mA, V_{CE} = 10 V, f = 1.0 kHz
h_{ie}	Small Signal Short Circuit Input Impedance		6.0	kΩ	I_C = 1.0 mA, V_{CE} = 10 V, f = 1.0 kHz
h_{oe}	Small Signal Open Circuit Open Conductance		40	μmho	I_C = 1.0 mA, V_{CE} = 10 V, f = 1.0 kHz

3

FAIRCHILD

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1N456/457/458/459
FDLL456/457/458/459
1N456A/457A/458A/459A
FDLL456A/457A/458A/459A
Low Leakage Diodes

- I_R . . . 25 nA (MAX) @ WIV
- C . . . 6.0 pf (MAX)

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature Range	−65°C to +200°C
Maximum Junction Operating Temperature	+175°C
Lead Temperature	+260°C

Power Dissipation (Note 2)

Maximum Total Power Dissipation at 25°C Ambient	500 mW
Linear Power Derating Factor (From 25°C)	3.33 mW/°C

Maximum Voltage and Currents		**1N456/A**	**1N457/A**	**1N458/A**	**1N459/A**
WIV	Working Inverse Voltage	25 V	60 V	125 V	175 V
I_O	Average Rectified Current				200 mA
I_F	Continuous Forward Current				500 mA
i_f	Peak Repetitive Forward Current				600 mA
$i_{f(surge)}$	Peak Forward Surge Current				
	Pulse Width = 1 μs				4.0 A
	Pulse Width = 1 s				1.0 A

PACKAGES

1N456	DO-35
1N457	DO-35
1N458	DO-35
1N459	DO-35
1N456A	DO-35
1N457A	DO-35
1N458A	DO-35
1N459A	DO-35
FDLL456	LL-34
FDLL457	LL-34
FDLL458	LL-34
FDLL459	LL-34
FDLL456A	LL-34
FDLL457A	LL-34
FDLL458A	LL-34
FDLL459A	LL-34

If you need this device in the SOT package, an electical equivalent is available. See FDSO1500 family.

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC		MIN	MAX	UNITS	TEST CONDITIONS
V_F	Forward Voltage	1N456A/7A/8A/9A		1.0	V	I_F = 100 mA
		1N456		1.0	V	I_F = 40 mA
		1N457		1.0	V	I_F = 20 mA
		1N458		1.0	V	I_F = 7 mA
		1N459		1.0	V	I_F = 3 mA
I_R	Reverse Current			25	nA	V_R = Rated WIV
				5.0	μA	V_R = Rated WIV, T_A = 150°C
BV	Breakdown Voltage	1N456/A	30		V	I_R = 100 μA
		1N457/A	70		V	I_R = 100 μA
		1N458/A	150		V	I_R = 100 μA
		1N459/A	200		V	I_R = 100 μA
C	Capacitance			6.0	pF	V_R = 0, f = 1 MHz

NOTES:
1. These ratings are limiting values above which the serviceability of the diode may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty-cycle operation.
3. For product family characteristic curves, refer to Chapter 4, D2.

FAIRCHILD

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1N461A/462A/463A
FDLL461A/462A/463A

General Purpose High Conductance Diodes

- V_F . . . 1.0 V (MAX) @ 100 mA
- I_R . . . 500 nA (MAX) @ WIV

PACKAGES

1N461A	DO-35
1N462A	DO-35
1N463A	DO-35
FDLL461A	LL-34
FDLL462A	LL-34
FDLL463A	LL-34

If you need this device in the SOT package, an electical equivalent is available. See FDSO1500 family.

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature Range	−65°C to +200°C
Maximum Junction Operating Temperature	+175°C
Lead Temperature	+260°C

Power Dissipation (Note 2)

Maximum Total Power Dissipation at 25°C Ambient	500 mW
Linear Power Derating Factor (from 25°C)	3.33 mW/°C

Maximum Voltage and Currents		**IN461A**	**IN462A**	**IN463A**	**IN464A**
WIV	Working Inverse Voltage	25 V	60 V	175 V	125 V
I_O	Average Rectified Current	200 mA	200 mA	200 mA	200 mA
I_F	Continuous Forward Current	500 mA	500 mA	500 mA	500 mA
i_f	Peak Repetitive Forward Current	600 mA	600 mA	600 mA	600 mA
$i_{f(surge)}$	Peak Forward Surge Current				
	Pulse Width = 1 s	1.0 A	1.0 A	1.0 A	1.0 A
	Pulse Width = 1 μs	4.0 A	4.0 A	4.0 A	4.0 A

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC		MIN	MAX	UNITS	TEST CONDITIONS
V_F	Forward Voltage			1.0	V	I_f = 100 mA
I_R	Reverse Current			500	nA	V_R = Rated WIV
				30	μA	V_R = Rated WIV, T_A = 150°C
BV	Breakdown Voltage	IN461A	30		V	I_R = 100 μA
		IN462A	70		V	I_R = 100 μA
		IN463A	200		V	I_R = 100 μA
		IN464A	150		V	I_R = 100 μA

NOTES:
1. These ratings are limiting values above which the serviceability of the diode may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty-cycle operation.
3. For product family characteristic curves, refer to Chapter 4, D2.

FAIRCHILD
A Schlumberger Company

1N482B/483B/484B/485B
FDLL482B/483B/484B/485B

General Purpose Low Leakage Diodes

- **V_F . . . 1.0 V (MAX) @ 100 mA**
- **I_R . . . 25 nA (MAX) @ WIV**

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature Range	−65°C to +200°C
Maximum Junction Operating Temperature	+175°C
Lead Temperature (from 25°C)	+260°C

Power Dissipation (Note 2)

Maximum Total Power Dissipation at 25°C Ambient	500 mW
Linear Power Derating Factor (from 25°C)	3.33 mW/°C

Maximum Voltage and Currents		**IN482B**	**IN483B**	**IN484B**	**IN485B**	**IN486B**
WIV	Working Inverse Voltage	36 V	70 V	130 V	180 V	225 V
I_O	Average Rectified Current					200 mA
I_F	Continuous Forward Current					500 mA
i_f	Peak Repetitive Forward Current					600 mA
$i_{f(surge)}$	Peak Forward Surge Current					
	Pulse Width = 1 s					1.0
	Pulse Width = 1 μs					4.0

PACKAGES

1N482B	DO-35
1N483B	DO-35
1N484B	DO-35
1N485B	DO-35
FDLL482B	LL-34
FDLL483B	LL-34
FDLL484B	LL-34
FDLL485B	LL-34

If you need this device in the SOT package, an electical equivalent is available. See FDSO1500 family.

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC		MIN	MAX	UNITS	TEST CONDITIONS
V_F	Forward Voltage			1.0	V	I_F = 100 mA
I_R	Reverse Current	1N482B − 1N485B		25	nA	V_R = Rated WIV
				5.0	μA	V_R = Rated WIV, T_A = 150°C
		1N486B		50	nA	V_R = 225 V
				10	μA	V_R = 225 V, T_A = 150°C
BV	Breakdown Voltage	1N482B	40		V	I_R = 100 μA
		1N483B	80		V	I_R = 100 μA
		1N484B	150		V	I_R = 100 μA
		1N485B	200		V	I_R = 100 μA
		1N486B	250		V	I_R = 100 μA

NOTES:
1. These ratings are limiting values above which the serviceability of the diode may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty-cycle operation.
3. For product family characteristic curves, refer to Chapter 4, D2.

FAIRCHILD

A Schlumberger Company

1N625/626/627/628/629
FDLL625/626/627/628/629

General Purpose Diodes

- V_F . . . 1.5 V (MAX) @ 4.0 mA
- I_R . . . 1.0 μA (MAX) @ WIV

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature Range	−65°C to +200°C
Maximum Operating Junction Temperature	175°C
Lead Temperatures	260°C

Power Dissipation (Notes 2)

Maximum Total Dissipation at 25°C Ambient	500 mW
Linear Derating Factor (from 25°C)	3.33 mW/°C

Maximum Voltage and Currents		**1N625**	**1N626**	**1N627**	**1N628**	**1N629**
WIV	Working Inverse Voltage	20 V	35 V	75 V	125 V	175 V
I_O	Average Rectified Current	175 mA	175 mA	175 mA	175 mA	175 mA
I_F	Forward Current Steady State	400 mA	400 mA	400 mA	400 mA	400 mA
$i_{f(surge)}$	Peak Forward Surge Current					
	Pulse Width = 1.0 s	1.0 A	1.0 A	1.0 A	1.0 A	1.0 A
	Pulse Width = 1.0 μs	4.0 A	4.0 A	4.0 A	4.0 A	4.0 A

PACKAGES

1N625	DO-35
1N626	DO-35
1N627	DO-35
1N628	DO-35
1N629	DO-35
FDLL625	LL-34
FDLL626	LL-34
FDLL627	LL-34
FDLL628	LL-34
FDLL629	LL-34

If you need this device in the SOT package, an electical equivalent is available. See FDSO1400 family.

3

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC		MIN	MAX	UNITS	TEST CONDITIONS
V_F	Forward Voltage			1.5	V	I_F = 4.0 mA
I_R	Reverse Current			1.0 30	μA μA	V_R = rated WIV V_R = rated WIV, T_A = 100°C
BV	Breakdown Voltage	1N625 1N626 1N627 1N628 1N629	30 50 100 150 200		V V V V V	I_R = 100 μA I_R = 100 μA I_R = 100 μA I_R = 100 μA I_R = 100 μA
t_{rr}	Reverse Recovery Time			1.0	μs	I_f = 30 mA, V_r = 35 V, Recovery to 400 kΩ

NOTES:
1. The maximum ratings are limiting values above which life or satisfactory performance may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. For product family characteristic curves, refer to Chapter 4, D1.

FAIRCHILD

A Schlumberger Company

1N658/FDLL658

General Purpose Diodes

- **BV . . . 120 V (MIN) @ 100 μA**
- **V_F . . . 1.0 V (MAX) @ 100 mA**

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature Range	−65°C to +200°C
Maximum Operating Junction Temperature	+175°C
Lead Temperature	+200°C

Power Dissipation (Note 2)

Maximum Total Dissipation at 25°C Ambient	500 mW
Linear Derating Factor (from 25°C)	3.33 mW/°C

Maximum Voltage and Currents

WIV	Working Inverse Voltage	100 V
I_O	Average Rectified Current	200 mA
I_F	Forward Current Steady State	500 mA
$i_{f(surge)}$	Peak Forward Surge Current	
	Pulse Width = 1.0s	1.0 A
	Pulse Width = 1.0μs	4.0 A

PACKAGES

1N658	DO-35
FDLL658	LL-34

If you need this device in the SOT package, an electical equivalent is available. See FDSO1400 family.

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
V_F	Forward Voltage		1.0	V	I_F = 100 mA
I_R	Reverse Current		50 25	nA μA	V_r = 50 V V_R = 50 V, T_A = 150°C
BV	Breakdown Voltage	120		V	I_R = 100 μA
t_{rr}	Reverse Recovery Time		300	ns	V_R = 40 V, I_f = 5.0 mA, R_L = 2.0 kΩ, C_L = 10 pF, Recovery to 80 kΩ

NOTES:
1. The maximum ratings are limiting values above which life or satisfactory performance may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. For product family characteristic curves, refer to Chapter 4, D1.

FAIRCHILD

A Schlumberger Company

1N659/660/661
FDLL659/660/661

General Purpose Diodes

- V_F . . . 1.0 V (MAX) @ 6.0 mA
- t_{rr} . . . 300 ns (MAX)

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature Range	−65°C to +200°C
Maximum Operating Junction Temperature	+175°C
Lead Temperature	+260°C

Power Dissipation (Notes 2)

Maximum Total Dissipation at 25°C Ambient	500 mW
Linear Derating Factor (from 25°C)	3.33 mW/°C

Maximum Voltage and Currents		**1N659**	**1N660**	**1N661**
WIV	Working Inverse Voltage	50 V	100 V	200 V
I_O	Average Rectified Current	200 mA	200 mA	200 mA
I_F	Forward Current Steady State	500 mA	500 mA	500 mA
$i_{f(surge)}$	Peak Forward Surge Current			
	Pulse Width = 1.0s	1.0 A	1.0 A	1.0 A
	Pulse Width = 1.0 μs	4.0 A	4.0 A	4.0 A

PACKAGES

1N659	DO-35
1N660	DO-35
1N661	DO-35
FDLL659	LL-34
FDLL660	LL-34
FDLL661	LL-34

If you need this device in the SOT package, an electical equivalent is available. See FDSO1200 family.

3

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	1N659		1N660		1N661		UNITS	TEST CONDITIONS
		MIN	MAX	MIN	MAX	MIN	MAX		
V_F	Forward Voltage		1.0		1.0		1.0	V	I_F = 6.0 mA
I_R	Reverse Current		5.0					μA	V_R = 50 V
					5.0			μA	V_R = 100 V
							10	μA	V_R = 200 V
			25					μA	V_R = 50 V, T_A = 100°C
					50			μA	V_R = 100 V, T_A = 100°C
							100	μA	V_R = 200 V, T_A = 100°C
BV	Breakdown Voltage	60		120		240		V	I_R = 100 μA
t_{rr}	Reverse Recovery Time		300		300		300	ns	V_r = 35 V, I_f = 30 mA, R_L = 2.0 kΩ, C_L = 10 pF, Recovery to 400 kΩ

NOTES:
1. The maximum ratings are limiting values above which life or satisfactory performance may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. For product family characteristic curves, refer to Chapter 4, D4 for 1N659, 4, D1 for 1N660 and 1N661.

FAIRCHILD

A Schlumberger Company

1N746 through 1N759

500 mW Silicon Linear Diodes

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature Range	−65°C to +200°C
Maximum Junction Operating Temperature	+175°C
Lead Temperature	+260°C

Power Dissipation (Note 2)

Maximum Total Power Dissipation at 25°C Ambient	500 mW
Linear Power Derating Factor (from 25°C)	3.33 mW/°C

PACKAGES

All Devices DO-35

ELECTRICAL CHARACTERISTICS (25°C Ambient unless otherwise noted)

SYMBOL	Z_Z	V_Z	I_R		TC
Characteristic	Maximum Zener Impedance (Note 4) (I_Z = 20 mA)	Nominal Zener Voltage (Note 3) (I_Z = 20 mA)	Maximum Reverse Current (V_R = 1.0V) @25°C	Maximum Reverse Current (V_R = 1.0V) @150°C	Typical Temperature Coefficient of V_Z
UNIT	Ω	V	μA	μA	%/°C
IN746	28.0	3.3	10.0	30.0	−0.070
IN747	24.0	3.6	10.0	30.0	−0.065
IN748	23.0	3.9	10.0	30.0	−0.060
IN749	22.0	4.3	2.0	30.0	−0.055
IN750	19.0	4.7	2.0	30.0	−0.043
IN751	17.0	5.1	1.0	20.0	±0.030
IN752	11.0	5.6	1.0	20.0	±0.028
IN753	7.0	6.2	0.1	20.0	+0.045
IN754	5.0	6.8	0.1	20.0	+0.050
IN755	6.0	7.5	0.1	20.0	+0.058
IN756	8.0	8.2	0.1	20.0	+0.062
IN757	10.0	9.1	0.1	20.0	+0.068
IN758	17.0	10.0	0.1	20.0	+0.075
IN759	30.0	12.0	0.1	20.0	+0.077

NOTES:
1. These ratings are limiting values above which the serviceability of the diode may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty-cycle operation.
3. Type numbers without suffix have ±10% tolerance on nominal V_Z.
   Type numbers with suffix A have ±5% tolerance on nominal V_Z.
4. The Zener impedance Z_Z is derived by superimposing a 60 Hz 2 mA (RMS) signal on the 20 mA I_Z test current.
5. For product family characteristic curves, refer to Chapter 4, D13.

FAIRCHILD

A Schlumberger Company

1N/FDLL914/A/B/916/A/B
1N/FDLL4148/4149/4446
1N/FDLL4447/4448/4449

High Conductance Ultra Fast Switching Diodes

- t_{rr} . . . 4.0 ns (MAX)
- BV . . . 100 V (MIN)

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature Range	−65° to +200°C
Max Junction Operating Temperature	+175°C
Lead Temperature	+260°C

Power Dissipation (Note 2)

Maximum Total Dissipation at 25°C	500 mW
Linear Derating Factor (from 25°C)	3.33 mW/°C

Maximum Voltage and Currents

WIV	Working Inverse Voltage	75 V
I_O	Average Rectified Current	200 mA
I_f	DC Forward Current	300 mA
i_f	Recurrent Peak Forward Current	400 mA
i_f(surge)	Peak Forward Surge Current	
	Pulse Width = 1.0 s	1.0 A
	Pulse Width = 1.0 μs	4.0 A

PACKAGES

1N914	DO-35
1N916	DO-35
1N914A	DO-35
1N914B	DO-35
1N916A	DO-35
1N916B	DO-35
1N4148	DO-35
1N4149	DO-35
1N4446	DO-35
1N4447	DO-35
1N4448	DO-35
1N4449	DO-35
FDLL914	LL-34
FDLL916	LL-34
FDLL914A	LL-34
FDLL914B	LL-34
FDLL916A	LL-34
FDLL916B	LL-34
FDLL4148	LL-34
FDLL4149	LL-34
FDLL4446	LL-34
FDLL4447	LL-34
FDLL4448	LL-34
FDLL4449	LL-34

If you need this device in the SOT package, an electical equivalent is available. See FDSO1200 family.

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC		MIN	MAX	UNITS	TEST CONDITIONS
BV	Breakdown Voltage		100		V	I_R = 100 μA
			75		V	I_R = 5.0 μA
I_R	Reverse Current			25	nA	V_R = 20 V
				50	μA	V_R = 20 V, T_A = 150°C
				5.0	μA	V_R = 75 V
V_F	Forward Voltage	1N914B, 1N4448	0.62	0.72	V	I_F = 5.0 mA
		1N916B, 1N4449	0.63	0.73	V	I_F = 5.0 mA
		1N914, 1N916, 1N4148, 1N4149		1.0	V	I_F = 10 mA
		1N914A, 1N916A, 1N4446, 1N4447		1.0	V	I_F = 20 mA
		1N916B, 1N4449		1.0	V	I_F = 30 mA
		1N914B, 1N4448		1.0	V	I_F = 100 mA
t_{rr}	Reverse Recovery Time			4.0	ns	I_f = 10 mA, V_r = 6.0 V, R_L = 100 Ω Rec. to 1.0 mA

NOTES:
1. Maximum ratings are limiting values above which life or satisfactory performance may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty-cycle operation.
3. For family characteristic curves, refer to Chapter 4, D4.

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC		MIN	MAX	UNITS	TEST CONDITIONS
C	Capacitance	1N914, 1N914A 1N914B, 1N4148 1N4446, 1N4447		4.0	pF	V_R = 0, f = 1 MHz
		1N916, 1N916A 1N916B, 1N4l49 1N4448, 1N4449		2.0	pF	V_R = 0, f = 1 MHz
V_{fr}	Peak Forward Recovery Voltage	1N914, 1N916 1N914B, 1N916B 1N4448, 1N4449		2.5	V	50 mA Peak Square Wave, 0.1 μs pulse width, 5 kHz - 100 kHz rep. rate
RE	Rectification Efficiency	1N914A, 1N914B 1N916A, 1N916B	45		%	2.0 V rms, f = 100 MHz

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A Schlumberger Company

1N957 through 1N973

500 mW Silicon Planar Zener Diodes

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperture Range	−65°C to +200°C
Maximum Junction Operating Temperature	+175°C
Lead Temperature	+260°C

Power Dissipation (Note 2)

Maximum Total Power Dissipation at 25°C Ambient	500 mW
Linear Power Derating Factor (from 25°C)	3.33 mW/°C

PACKAGES

All Devices DO-35

3

ELECTRICAL CHARACTERISTICS (25°C Ambient)

SYMBOL	V_Z	Z_Z	I_{ZT}	Z_{ZK}	I_{ZK}	I_R	V_{RT}			TC	I_{ZM}
Characteristics	Nominal Zener Voltage (Note 3) $@I_{ZT}$	Maximum Zener Impedance (Note 4) $@I_{ZT}$	Test Current	Maximum Zener Knee Impedance (Note 4) $@I_{ZK}$	Test Current	Maximum Reverse Current $@V_{RT}$	Test Voltage ±20% V_Z Tolerance	Test Voltage ±10% V_Z Tolerance	Test Voltage ±5% V_Z Tolerance	Typical Temperature Coefficient of V_Z	Maximum Zener Current (Note 5)
UNIT	V	Ω	mA	Ω	mA	μA	V	V	V	%/°C	mA
IN957	6.8	4.5	18.5	700	1.0	150	4.4	4.9	5.2	+0.050	47
IN958	7.5	5.5	16.5	700	0.5	75	4.8	5.4	5.7	+0.058	42
IN959	8.2	6.5	15.0	700	0.5	50	5.2	5.9	6.2	+0.062	38
IN960	9.1	7.5	14.0	700	0.5	25	5.8	6.6	6.9	+0.068	35
IN961	10.0	8.5	12.5	700	0.25	10	6.4	7.2	7.6	+0.072	32
IN962	11.0	9.5	11.5	700	0.25	5.0	7.0	8.0	8.4	+0.073	28
IN963	12.0	11.5	10.5	700	0.25	5.0	7.6	8.6	9.1	+0.076	26
IN964	13.0	13.0	9.5	700	0.25	5.0	8.3	9.4	9.9	+0.079	24
IN965	15.0	16.0	8.5	700	0.25	5.0	9.6	10.8	11.4	+0.082	21
IN966	16.0	17.0	7.8	700	0.25	5.0	10.2	11.5	12.2	+0.083	19
IN967	18.0	21.0	7.0	750	0.25	5.0	11.5	13.0	13.7	+0.085	17
IN968	20.0	25.0	6.2	750	0.25	5.0	12.8	14.4	15.2	+0.086	15
IN969	22.0	29.0	5.6	750	0.25	5.0	14.0	15.8	16.7	+0.087	14
IN970	24.0	33.0	5.2	750	0.25	5.0	15.4	17.3	18.2	+0.088	13
IN971	27.0	41.0	4.6	750	0.25	5.0	17.2	19.4	20.6	+0.090	11
IN972	30.0	49.0	4.2	1000	0.25	5.0	19.2	21.6	22.8	+0.091	10
IN973	33.0	58.0	3.8	1000	0.25	5.0	21.1	23.8	25.1	±0.092	9.2

NOTES:
1. These ratings are limiting values above which the serviceability of the diode may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty-cycle operation.
3. Type numbers without suffix have ±20% tolerance on nominal V_Z.
   Type numbers with suffix A have ±10% tolerance on nominal V_Z.
   Type numbers with suffix B have ±5% tolerance on nominal V_Z.
4. The Zener impedances Z_Z and Z_{ZK} are derived by superimposing a 60 Hz signal on test currents I_{ZT} and I_{ZK}, having an RMS value of 10% of the d.c. value of I_{ZT} and I_{ZK} respectively.
5. Maximum Zener Curent (I_{ZM}) is based on the maximum Zener voltage of a 20% tolerance unit.
6. For product family characteristic curves, refer to Chapter 4, D13.

FAIRCHILD

A Schlumberger Company

1N3064/4305/4454
FDLL3064/4305/4454

Ultra Fast Low Capacitance Diodes

- **C. . . 2.0 pF @ V_R = 0, f = 1.0 MHz**
- **t_{rr}. . . 4.0 ns @ I_f = 10 mA, I_r = 10 mA, V_r = 1.0 V**
- **BV. . . 75 V (MIN)**

PACKAGES

1N3064	DO-35
1N4305	DO-35
1N4454	DO-35
FDLL3064	LL-34
FDLL4305	LL-34
FDLL4454	LL-34

If you need this device in the SOT package, an electical equivalent is available. See FDSO1200 family.

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature Range	−65°C to +200°C
Max Junction Operating Temperature	+175°C
Lead Temperature	+260°C

Power Dissipation (Note 2)

Maximum Total Dissipation at 25°C	500 mW
Linear Derating Factor (from 25°C)	3.33 mW/°C

Maximum Voltages and Currents

WIV	Working Inverse Voltage	50 V
I_O	Average Rectified Current	100 mA
I_F	Forward Current Steady State	300 mA
i_f	Recurrent Peak Forward Current	400 mA
i_f (surge)	Peak Forward Surge Current	
	Pulse Width = 1.0 s	1.0 A
	Pulse Width = 1.0 μs	4.0 A

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
V_F	Forward Voltage	0.610	0.710	V	I_F = 2.0 mA
		0.550	0.650	V	I_F = 1.0 mA
		0.505	0.575	V	I_F = 250 μA
	1N3064, 1N4454		1.0	V	I_F = 10 mA
	1N4305	0.70	0.85	V	I_F = 10 mA
I_R	Reverse Current		0.1	μA	V_R = 50 V
			100	μA	V_R = 50 V, T_A = 150°C
BV	Breakdown Voltage	75		V	I_R = 5.0 μA
t_{rr}	Reverse Recovery Time (Note 3) 1N4305		2.0	ns	I_f = 10 mA, V_r = 6.0 V, R_L = 100 Ω
	1N3064, 1N4305, 1N4454		4.0	ns	I_f = I_r = 10 mA, R_L = 100 Ω, V_r = 1.0 V
C	Capacitance		2.0	pF	V_R = 0, f = 1.0 MHz
RE	Rectification Efficiency (Note 4)	45		%	f = 1.0 MHz
$\Delta V_F/°C$	Forward Voltage Temperature Coefficient (Note 5)		3.0	mV/°C	

NOTES:
1. The maximum ratings are limiting values above which life or satisfactory performance may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty-cycle operation.
3. Recovery to 1.0 mA.
4. Rectification efficiency is defined as the ratio of dc load voltage to peak rf input voltage to the detector circuit, measured with 2.0 V rms input to the circuit. Load resistance 5.0 Ω, load capacitance 20 pF
5. This value for $\Delta V_F/°C$ is a typical value not a minimum or maximum.
6. For product family characteristic curves, refer to Chapter 4, D4.

FAIRCHILD

A Schlumberger Company

1N3070/4938
FDLL3070/4938

High Speed High Conductance Diodes

- **BV . . . 200 V (MIN)**
- **I_R . . . 100 nA (MAX)**

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature Range	−65°C to +200°C
Max Junction Operating Temperature	+175°C
Lead Temperature	+260°C

Power Dissipation (Note 2)

Maximum Total Dissipation at 25°C Ambient	500 mW
Linear Derating Factor (from 25°C)	3.33 mW/°C

Maximum Voltage and Currents

WIV	Working Inverse Voltage	175 V
I_O	Average Rectified Current	200 mA
I_F	Forward Current Steady State DC	500 mA
i_f	Recurrent Peak Forward Current	600 mA
i_f (surge)	Peak Forward Surge Current	
	Pulse Width = 1.0 s	1.0 A
	Pulse Width = 1.0 μs	4.0 A

PACKAGES

1N3070	DO-35
1N4938	DO-35
FDLL3070	LL-34
FDLL4938	LL-34

If you need this device in the SOT package, an electical equivalent is available. See FDSO1400 family.

3

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
I_R	Reverse Current		100 100	nA μA	V_R = 175 V V_R = 175 V, T_A = 150°C
BV	Breakdown Voltage	200		V	I_R = 100 μA
V_F	Forward Voltage		1.0	V	I_F = 100 mA
C	Capacitance		5.0	pF	V_R = 0, f = 1.0 MHz
t_{rr}	Reverse Recovery Time (Note 3)		50	ns	$I_f = I_r$ = 30 mA, R_L = 100Ω
RE	Rectification Efficiency (Note 4)	35		%	f = 100 MHz

NOTES:
1. The maximum ratings are limiting values above which life or satisfactory performance may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty-cycle operation.
3. Recovery to 1.0 mA.
4. Rectification efficiency is defined as the ratio of dc load voltage to peak rf input voltage to the detector circuit, measured with 2.0 V rms input to the circuit. Load resistance: 5.0 kΩ, load capacitance 20 pF.
5. 1N3070 and IN4938 are electrically and mechanically identical.
6. For product family characteristic curves, refer to Chapter 4, D1.

FAIRCHILD

A Schlumberger Company

1N3595/6099
FDLL3595/6099
High Conductance Low Leakage Diodes

- BV . . . 150 V (MIN) @ 100 μA
- V_F . . . 1.0 V @ 200 mA

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature Range	−65°C to +200°C
Max Junction Operating Temperature	+175°C
Lead Temperature	+260°C

Power Dissipation (Note 2)

Maximum Total Dissipation at 25°C Ambient	500 mW
Linear Derating Factor (From 25°C)	3.33 mW / °C

Maximum Voltage and Currents

WIV	Working Inverse Voltage	125 V
I_O	Average Rectified Current	200 mA
I_F	Forward Current Steady State	500 mA
i_f	Peak Repetitive Forward Current	600 mA
i_f (surge)	Peak Forward Surge Current	
	Pulse Width = 1.0 s	1.0 A
	Pulse Width = 1.0 μs	4.0 A

PACKAGES

1N3595	DO-35
1N6099	DO-35
FDLL3595	LL-34
FDLL6099	LL-34

If you need this device in the SOT package, an electical equivalent is available. See FDSO1500 family.

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
V_F	Forward Voltage	0.83	1.0	V	I_F = 200 mA
		0.79	0.92	V	I_F = 100 mA
		0.75	0.88	V	I_F = 50 mA
		0.65	0.80	V	I_F = 10 mA
		0.60	0.75	V	I_F = 5.0 mA
		0.52	0.68	V	I_F = 1.0 mA
I_R	Reverse Current		1.0	nA	V_R = 125 V
			300	nA	V_R = 30 V, T_A = 125°C
			500	nA	V_R = 125 V, T_A = 125°C
			3.0	μA	V_R = 125 V, T_A = 150°C
t_{rr}	Reverse Recovery Time		3.0	μs	I_F = 10 mA, V_r = 3.5 V, R_L = 1.0 kΩ
C	Capacitance		8.0	pF	V_R = 0, f = 1.0 MHz
BV	Breakdown Voltage	150		V	I_R = 100 μA

NOTES:
1. The maximum ratings are limiting values above which life or satisfactory performance may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty-cycle operation.
3. 1N3595 and IN6099 are electrically and mechanically identical.
4. For product family characteristic curves, refer to Chapter 4, D2.

FAIRCHILD

A Schlumberger Company

1N3600/FDLL3600
1N4150/FDLL4150
1N4450/FDLL4450

High Conductance Ultra Fast Diodes

- t_{rr} . . . 4.0 ns (MAX)
- V_F . . . 1.0 V (MAX) @ 200 mA

PACKAGES

1N3600	DO-35
1N4150	DO-35
1N4450	DO-35
FDLL3600	LL-34
FDLL4150	LL-34
FDLL4450	LL-34

If you need this device in the SOT package, an electical equivalent is available. See FDSO1200 family.

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature Range	−65°C to +200°C
Max Junction Operating Temperature	+175°C
Lead Temperature	+260°C

Power Dissipation (Note 2)

Max Total Power Dissipation at 25°C Ambient	500 mW
Linear Derating Factor (from 25°C)	3.33 mW/°C

Maximum Voltages and Currents

		1N3600	1N4150	1N4450
WIV	Working Inverse Voltage	50 V	50 V	30 V
I_O	Average Rectified Current	200 mA	200 mA	200 mA
I_F	DC Forward Current	400 mA	400 mA	400 mA
i_f	Recurrent Peak Forward Current	600 mA	600 mA	600 mA
$i_{f(surge)}$	Peak Forward Surge Current			
	Pulse Width = 1.0 s	1.0 A	1.0 A	1.0 A
	Pulse Width = 1.0 μs	4.0 A	4.0 A	4.0 A

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	1N3600 1N4150 MIN	1N3600 1N4150 MAX	1N4450 MIN	1N4450 MAX	UNITS	TEST CONDITIONS
BV	Breakdown Voltage	75				V	I_R = 5.0 μA
				40		V	I_R = 5.0 μA
I_R	Reverse Current		100			nA	V_R = 50 V
					50	nA	V_R = 30 V
			100			μA	V_R = 50 V, T_A = 150°C
					50	μA	V_R = 30 V, T_A = 150°C
V_F	Forward Voltage			0.42	0.54	V	I_F = 0.1 mA
		0.54	0.62	0.52	0.64	V	I_F = 1.0 mA
		0.66	0.74	0.64	0.76	V	I_F = 10 mA
		0.76	0.86			V	I_F = 50 mA
		0.82	0.92	0.80	0.92	V	I_F = 100 mA
		0.87	1.0		1.0	V	I_F = 200 mA
C	Capacitance		2.5		4.0	pF	V_R = 0, f = 1.0 MHz
t_{rr}	Reverse Recovery Time (Note 3)		4.0			ns	$I_f = I_r$ = 10 mA to 200 mA, R_L = 100 Ω
					4.0	ns	$I_f = I_r$ = 10 mA, R_L = 100 Ω
			6.0			ns	$I_f = I_r$ = 200 mA to 400 mA, R_L = 100 Ω
t_{fr}	Forward Recovery Time		10			ns	I_f = 200 mA, t_r = 0.4 ns, V_{fr} = 1.0 V

NOTES:
1. Maximum ratings are limiting values above which life or satisfactory performance may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty-cycle operation.
3. Recovery to 0.1 I_f.
4. For family characteristic curves, refer to Chapter 4, D4.

FAIRCHILD
A Schlumberger Company

1N4009/FDLL4009

Ultra High Speed Diodes

- t_{rr} . . . 2 ns (MAX)
- BV . . . 35 V (MIN) @ 5 μA

PACKAGES

1N4009	DO-35
FDLL4009	LL-34

If you need this device in the SOT package, an electical equivalent is available. See FDSO1200 family.

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature Range	−65°C to +200°C
Maximum Junction Operating Temperature	+175°C
Lead Temperature	+260°C

Power Dissipation (Note 2)

Maximum Total Power Dissipation at 25°C Ambient	500 mW
Linear Power Derating Factor	3.33 mW / °C

Maximum Voltage and Current

WIV	Working Inverse Voltage	25 V
I_O	Average Rectified Current	100 mA
I_F	Continuous Forward Current	300 mA
i_f	Peak Repetitive Forward Current	400 mA
i_f (surge)	Peak Forward Surge Current	
	Pulse Width = 1 s	1.0 A
	Pulse Width = 1 μs	4.0 A

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
V_F	Forward Voltage		1.0	V	I_F = 30 mA
I_R	Reverse Current		0.1 100	μA μA	V_R = 25 V V_R = 25 V, T_A = 150°C
BV	Breakdown Voltage	35		V	I_R = 5.0 μA
t_{rr}	Reverse Recovery Time		4.0 2.0	ns ns	$I_f = I_r$ = 10 mA (Note 3) I_f = 10 mA, V_r = 6.0 V, R_L = 100 Ω
C	Capacitance		4.0	pF	V_R = 0,f = 1.0 MHz

NOTES:
1. These ratings are limiting values above which the serviceability of the diode may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty-cycle operation.
3. Recovery to 1.0 mA.
4. For product family characteristic curves, refer to Chapter 4, D4

FAIRCHILD
A Schlumberger Company

1N/FDLL4151/4152
1N/FDLL4153/4154
High Speed Diodes

- C . . . 4 pF (MAX)
- t_{rr} . . . 2 nS (MAX) @ 10 mA, −6 V, 100 Ω

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature Range	−65°C to +200°C
Maximum Junction Operating Temperature	+175°C
Lead Temperature	+260°C

Power Dissipation (Note 2)

Maximum Total Power Dissipation at 25°C Ambient	500 mW
Linear Power Derating Factor	3.33 mW/°C

Maximum Voltage and Currents

WIV	Working Inverse Voltage	1N4151 50 V 1N4152 30 V	1N4153 50 V 1N4154 25 V
I_O	Average Rectified Current		100 mA
I_F	Continuous Forward Current		300 mA
i_f	Peak Repetitive Forward Current		400 mA
$i_{f\ (surge)}$	Peak Forward Surge Current		
	Pulse Width = 1 s		1.0 A
	Pulse Width = 1 μs		4.0 A

PACKAGES

1N4151	DO-35
1N4152	DO-35
1N4153	DO-35
1N4154	DO-35
FDLL4151	LL-34
FDLL4152	LL-34
FDLL4153	LL-34
FDLL4154	LL-34

3

If you need this device in the SOT package, an electical equivalent is available. See FDSO1200 family.

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC		MIN	MAX	UNITS	TEST CONDITIONS
V_F	Forward Voltage	1N4154		1.0	V	I_F = 30 mA
		1N4151		1.0	V	I_F = 50 mA
		1N4152 & 1N4153	0.49	0.55	V	I_F = 0.1 mA
			0.53	0.59	V	I_F = 0.25 mA
			0.59	0.67	V	I_F = 1.0 mA
			0.62	0.70	V	I_F = 2.0 mA
			0.70	0.81	V	I_F = 10 mA
			0.74	0.88	V	I_F = 20 mA
I_R	Reverse Current	1N4154		0.1	μA	V_R = 25 V
				100	μA	V_R = 25 V, T_A = 150°C
		1N4153 1N4151		0.05	μA	V_R = 50 V
				50	μA	V_R = 50 V, T_A = 150°C
		1N4152		0.05	μA	V_R = 30 V
				50	μA	V_R = 30 V, T_A = 150°C
BV	Breakdown Voltage	1N4154	35		V	I_R = 5.0 μA
		1N4153 1N4151	75		V	I_R = 5.0 μA
		1N4152	40		V	I_R = 5.0 μA
t_{rr}	Reverse Recovery Time			4.0	ns	I_f = 10 mA, I_r = 10 mA (Note 3)
				2.0	ns	I_f = 10 mA V_r = −6.0 V, R_L = 100 Ω
C	Capacitance			4.0	pF	V_R = 0, f = 1.0 MHz

NOTES:
1. The maximum ratings are limiting values above which satisfactory performance may be impaired.
2. These are steady state limits. The factory should be consulted in applications involving pulsed or low duty cycle operation.
3. Recovery to 1.0 mA.
4. For product family characteristic curves, refer to Chapter 4, D4.

FAIRCHILD

A Schlumberger Company

1N4306/1N4307

Pair and Quad Assemblies Diodes

The 1N4306 and 1N4307 are JAN assemblies of two and four glass diodes respectively. They feature tightly matched forward voltages over broad current and temperature ranges.

- **ΔV_F... 10 mV (MAX)**
- **C...2.0 pF (MAX)**

PACKAGES

1N4306	DO-7
1N4307	DO-7

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature Range	−65°C to +150°C
Maximum Junction Operating Temperature	+150°C
Lead Temperature	+260°C

Power Dissipation (Note 2)

Maximum Total Power Dissipation at 25°C Ambient	
Each Diode	250 mW
Linear Derating Factor (from 25°C)	
Each Diode	2.0 mW / °C

Maximum Voltage and Currents

WIV	Working Inverse Voltage	50 V
I_O	Average Rectified Current	200 mA
I_F	Continuous Forward Current	300 mA
i_f	Recurrent Peak Forward Current	600 mA
$i_{f(surge)}$	Peak Forward Surge Current	
	Pulse Width = 1.0 s	1.0 A
	Pulse Width = 1.0 μs	4.0 A

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV	Breakdown Voltage	75		V	I_R = 5.0 mA
I_R	Reverse Current		50	nA	V_R = 50 V
			50	nA	V_R = 50 V, TA = 150°C
V_F	Forward Voltage	0.75	1.00	V	I_F = 50 mA
		0.67	0.81	V	I_F = 10 mA
		0.56	0.67	V	I_F = 1.0 mA
		0.44	0.55	V	I_F = 100 μA
C	Capacitance		2.0	pF	V_R = 0, f = 1 MHz
t_{rr}	Reverse Recovery Time		4.0	ns	$I_f = I_r$ = 10 mA, R_L = 100Ω Recovery to 1 mA
ΔV_F	Forward Voltage Match (Note 4)		10	mV	I_F = 0.1 to 10 mA T_A = −55°C to +125°C
			20	mV	I_F = 10 to 50 mA T_A = −55°C to +125°C

NOTES:

1. These are limiting values above which life or satisfactory performance may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty-cycle operation.
3. For product family characteristic curves, refer to Chapter 4, D4.
4. For test circuits, refer to Chapter 4, D18.

FAIRCHILD

A Schlumberger Company

1N4728 through 1N4752

1 W Silicon Zener Diodes

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature Range	−65°C to +200°C
Maximum Junction Operating Temperature	+200°C
Lead Temperature	+260°C

Power Dissipation (Note 2)

Maximum Total Dissipation at 50°C Ambient	1 W
Linear Power Derating Factor (from 50°C)	6.67 mW/°C
Maximum Surge Power (Note 8)	10 W

PACKAGES

All Devices DO-41

3

ELECTRICAL CHARACTERISTICS (25°C Ambient)

SYMBOL	V_Z	Z_Z	I_{ZT}	Z_{ZK}	I_{ZK}	I_R	V_{RT}	I_{ZM}	i_Z (surge)
Characteristic	Nominal Zener Voltage (Note 4) @I_{ZT}	Maximum Zener Impedance (Note 5) @I_{ZT}	Test Current	Maximum Zener Knee Impedance (Note 5) @I_{ZK}	Test Current	Maximum Reverse Current @V_{RT}	Test Voltage	Maximum Zener Current (Note 6)	Maximum Zener Surge Current (Note 3)
UNIT	V	Ω	mA	Ω	mA	μA	V	mA	mA
IN4728	3.3	10.0	76.0	400	1.0	100	1.0	276	1380
IN4729	3.6	10.0	69.0	400	1.0	100	1.0	252	1260
IN4730	3.9	9.0	64.0	400	1.0	50	1.0	234	1190
IN4731	4.3	9.0	58.0	400	1.0	10	1.0	217	1070
IN4732	4.7	8.0	53.0	500	1.0	10	1.0	193	970
IN4733	5.1	7.0	49.0	550	1.0	10	1.0	178	890
IN4734	5.6	5.0	45.0	600	1.0	10	2.0	162	810
IN4735	6.2	2.0	41.0	700	1.0	10	3.0	146	730
IN4736	6.8	3.5	37.0	700	1.0	10	4.0	133	660
IN4737	7.5	4.0	34.0	700	0.5	10	5.0	121	605
IN4738	8.2	4.5	31.0	700	0.5	10	6.0	110	550
IN4739	9.1	5.0	28.0	700	0.5	10	7.0	100	500
IN4740	10.0	7.0	25.0	700	0.25	10	7.6	91	454

NOTES:
1. These ratings are limiting values above which the serviceability of the diode may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty-cycle operation.
3. Non-recurrent square wave, PW = 8.3 ms, superimposed on Zener test current, I_{ZT}.
4. Type numbers without suffix have ± 10% tolerance on nominal V_Z. Type numbers with suffix A have ±5% tolerance on nominal V_Z.
5. The Zener impedances Z_Z and Z_{ZK} are derived by superimposing a 60 H_Z signal on test currents I_{ZT} and I_{ZK}, having an RMS value of 10% of the d.c. value of I_{ZT} and I_{ZK} respectively.
6. Maximum Zener Current (I_{ZM}) is based on the maximum Zener voltage of a 10% tolerance unit.
7. V_F = 1.2 V (max) @ I_F = 200 mA for all types. Non-recurrent square wave, PW = 8.3 ms, T_A = 55°C.
8. Non-recurrent square wave. PW = 8.3 ms, T_A = 55°C
9. For product family characteristic curves, refer to Chapter 4, D14.

ELECTRICAL CHARACTERISTICS (25°C Ambient)

SYMBOL	V_Z	Z_Z	I_{ZT}	Z_{ZK}	I_{ZK}	I_R	V_{RT}	I_{ZM}	i_Z (surge)
Characteristic	Nominal Zener Voltage (Note 4) @I_{ZT}	Maximum Zener Impedance (Note 5) @I_{ZT}	Test Current	Maximum Zener Knee Impedance (Note 5) @I_{ZK}	Test Current	Maximum Reverse Current @V_{RT}	Test Voltage	Maximum Zener Current (Note 6)	Maximum Zener Surge Current (Note 3)
UNIT	V	Ω	mA	Ω	mA	μA	V	mA	mA
IN4741	11.0	8.0	23.0	700	0.25	5.0	8.4	83	414
IN4742	12.0	9.0	21.0	700	0.25	5.0	9.1	76	380
IN4743	13.0	10.0	19.0	700	0.25	5.0	9.9	69	344
IN4744	15.0	14.0	17.0	700	0.25	5.0	11.4	61	304
IN4745	16.0	16.0	15.5	700	0.25	5.0	12.2	57	285
IN4746	18.0	20.0	14.0	750	0.25	5.0	13.7	50	250
IN4747	20.0	22.0	12.5	750	0.25	5.0	15.2	45	225
IN4748	22.0	23.0	11.5	750	0.25	5.0	16.7	41	205
IN4749	24.0	25.0	10.5	750	0.25	5.0	18.2	38	190
IN4750	27.0	35.0	9.5	750	0.25	5.0	20.6	34	170
IN4751	30.0	40.0	8.5	1000	0.25	5.0	22.8	30	150
IN4752	33.0	45.0	7.5	1000	0.25	5.0	25.1	27	135

FAIRCHILD

A Schlumberger Company

1N5226 through 1N5257

500 mW Silicon Zener Diodes

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures	
Storage Temperature Range	−65°C to +200°C
Maximum Junction Operating Temperature	+200°C
Lead Temperature	+260°C
Power Dissipation (Note 2)	
Maximum Total Power Dissipation at 75°C Ambient	500 mW
Linear Power Derating Factor (from 75°C)	4.0 mW / °C
Maximum Surge Power (Note 3)	10 W

PACKAGES

All Devices DO-35

3

ELECTRICAL CHARACTERISTICS (25°C Ambient unless otherwise noted)

SYMBOL	V_Z	Z_Z	I_{ZT}	Z_{ZK}	I_R		V_{RT}		TC
Characteristic	Nominal Zener Voltage (Note 4) @I_{ZT}	Maximum Zener Impedance (Note 5) @I_{ZT}	Test Current	Maximum Zener Knee Impedance (Note 5) @ I_{ZK} = 0.25 mA	Maximum Reverse Current @ V_{RT} ±20% V_ZTolerance	Maximum Reverse Current @ V_{RT} ±10, 5, 2, 1% V_ZTolerance	Test Voltage ±20, 10% V_ZTolerance	Test Voltage ±5, 2, 1% V_ZTolerance	Maximum Temperature Coefficient of V_Z (Note 6)
UNIT	V	Ω	mA	Ω	μA	μA	V	V	%/°C
IN5226	3.3	28	20	1600	100	25	0.95	1.0	−0.070
IN5227	3.6	24	20	1700	100	15	0.95	1.0	−0.065
IN5228	3.9	23	20	1900	75	10	0.95	1.0	−0.060
IN5229	4.3	22	20	2000	50	5.0	0.95	1.0	±0.055
IN5230	4.7	19	20	1900	50	5.0	1.9	2.0	±0.030
IN5231	5.1	17	20	1600	50	5.0	1.9	2.0	±0.030
IN5232	5.6	11	20	1600	50	5.0	2.9	3.0	+0.038
IN5233	6.0	7.0	20	1600	50	5.0	3.3	3.5	+0.038
IN5234	6.2	7.0	20	1000	50	5.0	3.8	4.0	+0.045
IN5235	6.8	5.0	20	750	30	3.0	4.8	5.0	+0.050
IN5236	7.5	6.0	20	500	30	3.0	5.7	6.0	+0.058
IN5237	8.2	8.0	20	500	30	3.0	6.2	6.5	+0.062
IN5238	8.7	8.0	20	600	30	3.0	6.2	6.5	+0.065
IN5239	9.1	10	20	600	30	3.0	6.7	7.0	+0.068
IN5240	10.0	17	20	600	30	3.0	7.6	8.0	+0.075
IN5241	11.0	22	20	600	30	2.0	8.0	8.4	+0.076

NOTES:

1. These ratings are limiting values above which the serviceability of the diode may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty-cycle operation.
3. Non-recurrent square wave, PW = 8.3 ms, T_A = 55°C.
4. Type numbers without suffix have ±20% tolerance on nominal V_Z.
   Type numbers with suffix A have ±10% tolerance on nominal V_Z.
   Type numbers with suffix B have ±5% tolerance on nominal V_Z.
   Type numbers with suffix C have ±2% tolerance on nominal V_Z.
   Type numbers with suffix D have ±1% tolerance on nominal V_Z.
5. The Zener impedances Z_Z and Z_{ZK} are derived by superimposing a 60 H_Z signal on test currents I_{ZT} and I_{ZK}, having an RMS value of 10% of the d.c. value of I_{ZT} and I_{ZK} respectively.
6. Maximum temperature coefficients apply to 10, 5, 2 and 1% tolerance types only and are measured under the following conditions:
   IN5226A, B, C, D through IN5242A, B, C, D: I_Z = 7.5 mA, T_1 = 25°C, T_2 = 125°C.
   IN5242A, B, C, D through IN5257A, B, C, D: I_Z = I_{ZT}, T_1 = 25°C, T_2 = 125°C.
7. V_F = 1.1V (maximum) @ I_F = 200 mA for all types.
8. For product family characteristic curves, refer to Chapter 4, D13.

ELECTRICAL CHARACTERISTICS (25°C Ambient unless otherwise noted)

SYMBOL	V_Z	Z_Z	I_{ZT}	Z_{ZK}	I_R		V_{RT}		TC
Characteristic	Nominal Zener Voltage (Note 4) @I_{ZT}	Maximum Zener Impedance (Note 5) @I_{ZT}	Test Current	Maximum Zener Knee Impedance (Note 5) @ I_{ZK} = 0.25 mA	Maximum Reverse Current @ V_{RT}		Test Voltage		Maximum Temperature Coefficient of V_Z (Note 6)
					±20% V_Z Tolerance	±10, 5, 2, 1% V_Z Tolerance	±20, 10% V_Z Tolerance	±5, 2, 1% V_Z Tolerance	
UNIT	V	Ω	mA	Ω	μA	μA	V	V	%/°C
IN5242	12.0	30	20	600	10	1.0	8.7	9.1	+0.077
IN5243	13.0	13	9.5	600	10	0.5	9.4	9.9	+0.079
IN5244	14.0	15	9.0	600	10	0.1	9.5	10.0	+0.082
IN5245	15.0	16	8.5	600	10	0.1	10.5	11.0	+0.082
IN5246	16.0	17	7.8	600	10	0.1	11.4	12.0	+0.083
IN5247	17.0	19	7.4	600	10	0.1	12.4	13.0	+0.084
IN5248	18.0	21	7.0	600	10	0.1	13.3	14.0	+0.085
IN5249	19.0	23	6.6	600	10	0.1	13.3	14.0	+0.086
IN5250	20.0	25	6.2	600	10	0.1	14.3	15.0	+0.086
IN5251	22.0	29	5.6	600	10	0.1	16.2	17.0	+0.087
IN5252	24.0	33	5.2	600	10	0.1	17.1	18.0	+0.088
IN5253	25.0	35	5.0	600	10	0.1	18.1	19.0	+0.089
IN5254	27.0	41	4.6	600	10	0.1	20.0	21.0	+0.090
IN5255	28.0	44	4.5	600	10	0.1	20.0	21.0	+0.091
IN5256	30.0	49	4.2	600	10	0.1	22.0	23.0	+0.091
IN5257	33.0	58	3.8	700	10	0.1	24.0	25.0	+0.092

FAIRCHILD

A Schlumberger Company

1N5282

High Conductance Ultra Fast Diodes

- **BV . . . 80 V (MIN) @ 5.0 μA**
- **C . . . 2.5 pF @ V_R = 0 V, f = 1.0 MHz**
- **t_{rr} . . . 4.0 ns @ $I_f = I_r$ = 10 mA to 200 mA**

PACKAGES

1N5282	DO-35

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature Range	−65°C to +200°C
Maximum Junction Operating Temperature	+175°C
Lead Temperature	+260°C

Power Dissipation (Note 2)

Maximum Total Dissipation at 25° Ambient	500 mW
Linear Derating Factor (from 25°C)	3.33 mW/°C

Maximum Voltage and Currents

WIV	Working Inverse Voltage	55 V
I_O	Average Rectified Current	200 mA
I_F	Continuous Forward Current	300 mA
$i_{f(surge)}$	Peak Forward Surge Current	
	Pulse Width = 1.0 s	1.0 A
	Pulse Width = 1.0 μs	4.0 A

3

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
V_F	Forward Voltage	1.05	1.30	V	I_F = 500 mA
		0.92	1.10	V	I_F = 300 mA
		0.80	0.90	V	I_F = 100 mA
		0.67	0.725	V	I_F = 10 mA
		0.55	0.60	V	I_F = 1.0 mA
		0.45	0.49	V	I_F = 0.1 mA
I_R	Reverse Current		100	nA	V_R = 55 V
			100	μA	V_R = 55 V, T_A = 150°C
BV	Breakdown Voltage	80		V	I_R = 5.0 μA
t_{rr}	Reverse Recovery Time (Note 3)		4.0	ns	$I_f = I_r$ = 10 mA to 200 mA, R_L = 100 Ω
t_{rr}	Reverse Recovery Time		2.0	ns	I_f = 10 mA, V_r = 6.0 V
t_{fr}	Forward Recovery Time		10	ns	I_f = 200 mA (Note 4)
V_{pk}	Peak Forward Voltage		2.0	V	I_f = 500 mA (Note 5)
C	Capacitance		2.5	pF	V_R = 0, f = 1.0 MHz

NOTES:
1. The maximum ratings are limiting values above which life or satisfactory performance may be impaired.
2. These are steady-state limits. The factory should be consulted on applications involving pulsed or low duty-cycle operation.
3. Recovery to 0.1 I_r.
4. t_r = 0.4 ns, V_{fr} = 1.0 V, pulse width = 100 ns; duty cycle ≤ 1%.
5. t_r = 8.0 ns, pulse width = 1.0 μs; duty cycle ≤ 1%.
6. For product family characteristics curves, refer to Chapter 4, D4.

FAIRCHILD

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1N5768/1N5770/1N5772 1N5774/FASO5768/FASO5770 FASO5772/FASO5774

Monolithic Air Isolated Diode Arrays

- BV . . . 60 V @ 10 μA
- I_R . . . 100 nA @ 40 V
- V_R . . . 1 V @ 100 mA

PACKAGE

1N5768	TO-85
1N5770	TO-85
1N5772	TO-85
1N5774	TO-86
FASO5768	8-SOIC
FASO5770	8-SOIC
FASO5772	8-SOIC
FASO5774	14-SOIC

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature Range	−65°C to +200°C
Junction Operating Temperature Range	−65°C to +200°C

Maximum Power Dissipation

Maximum Total Dissipation at T_A = 25°C	500 mW
Linear Derating Factor	4.0 mW / °C above 25°C

Maximum Currents

I_O	Average Rectified Current (each diode)	300 mA
	Linear Derating Factor	2.4 mA / °C above 25°C
I_{FSM}	Peak Forward Surge Current Pulse Width = 8.3 ms	500 mA

For SOIC power dissipation, consult factory.

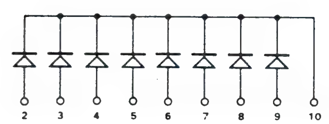
ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV	Breakdown Voltage	60		V	I_R = 10 μA, Pulse Width = 100 μs, Duty Cycle ≤ 20%
V_F	Forward Voltage		1.0 1.5	V V	I_F = 100 mA I_F = 500 mA, Pulse Width = 300 ns, Duty Cycle = 2%
V_{FX}	Forward Voltage		1.0	V	I_F = 25 mA; I_F = 25 mA for each of the other Diodes in the Test Section (Note 3)
V_{FM}	Peak Forward Voltage		5.0	V	I_F = 500 mA, Pulse Width = 150 ns, Duty Cycle ≤2%
I_R	Reverse Current		100 50	nA μA	V_R = 40 V V_R = 40 V, T_A = +150°C
I_{RX}	Reverse Current		10	μA	V_R = 40 V, I_F = 25 mA for each of the other Diodes in the Test Section (Note 3)
I_{Ri}	Isolation Current 1N5772, 1N5774		0.8	μA	V_R = 40 V (Note 4)
C	Pin-to-Pin Capacitance (Note 2) 1N5768 1N5770, 1N5772, 1N5774		 4.0 8.0	 pF pF	 V_R = 0 V, f = 1.0 MHz V_R = 0 V, f = 1.0 MHz
t_{fr}	Forward Recovery Time (Note 5)		40	ns	I_f = 500 mA, R_S = 10 Ω, V_{fr} = 1.8 V, t_r = 15 ns Max
t_{rr}	Reverse Recovery Time (Note 5)		20	ns	I_f = 200 mA, I_r = 200 mA, R_L = 100 Ω, I_{rr} = 20 mA

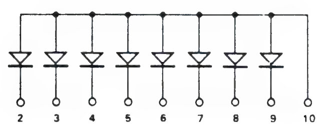
NOTES:
1. The maximum ratings are limiting values above which life or satisfactory performance may be impaired.
2. This parameter is the total pin-to-pin capacitance measured across each diode. This does not necessarily represent actual diode capacitance since other diode interconnections can contribute additional capacitance.
3. Each common anode section and / or common cathode section tested separately.
4. The isolation current shall be measured between any two interconnect pins of adjacent parallel sets of diodes with all other pins open circuited.
5. For Product Family characteristic curves and Test Circuits, refer to Chapter 4, D15.

1N5768/1N5770/1N5772
1N5774/FASO5768/FASO5770
FASO5772/FASO5774

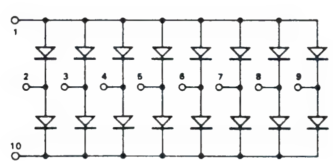
Connection Diagrams



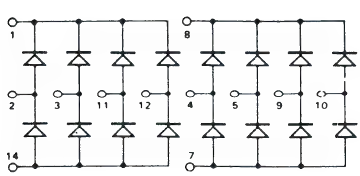
1N5768 FASO5768



1N5770 FASO5770



1N5771 FASO5772



1N5774 FASO5774

FAIRCHILD

A Schlumberger Company

1N6100/1N6101
FASO6101
Monolithic Air Isolated Diode Arrays

- **C . . . 3.0 pF (MAX)**
- **ΔV_F . . . 10 mV (MAX) @ 10 μA**

ABSOLUTE MAXIMUM RATINGS (Note 1)

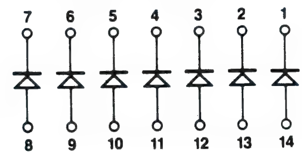
Temperatures	
Storage Temperature Range	−55°C to +200°C
Maximum Junction Operating Temperature	+175°C
Lead Temperature	+260°C
Power Dissipation (Note 2)	
Maximum Dissipation per Junction at 25°C Ambient	400 mW
Maximum Dissipation per Package at 25°C Ambient	600 mW
Linear Derating Factor (from 25°C) Junction	2.67 mW/°C
Package	4.0 mW/°C

Maximum Voltage and Currents

WIV	Working Inverse Voltage	65 V
I_F	Continuous Forward Current	350 mA
$i_{f(surge)}$	Peak Forward Surge Current	
	Pulse Width = 1.0 s	1.0 A
	Pulse Width = 1.0 μs	2.0 A

For SOIC power dissipation, consult factory.

Connection Diagrams



PACKAGES

1N6100	TO-86
1N6101	TO-116-2
FASO6101	14-SOIC

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV	Breakdown Voltage	75		V	I_R = 5.0 μA
I_R	Reverse Current (Note 4)		25 50	nA μA	V_R = 20 V V_R = 20 V, T_A = 150°C
V_F	Forward Voltage (Note 3)		1.0	V	I_F = 100 mA
V_{FM}	Peak Forward Voltage		5.0	V	I_F = 100 μA, PW = 100 ns Duty Cycle $\leq$2%
I_{RX}	Reverse Current (Note 5)		10	μA	V_R = 40 V
V_{FX}	Forward Voltage (Note 5)		1.0	V	I_F = 25 mA
C	Capacitance		3.0	pF	V_R = 0, f = 1 MHz
t_{fr}	Forward Recovery Time (Note 6)		15	ns	I_f = 100 mA, R_S = 50 Ω V_{fr} = 1.1 V, $t_r \leq$ 10 ns
t_{rr}	Reverse Recovery Time (Note 6)		5.0	ns	$I_f = I_r$ = 10 mA I_{rr} = 1.0 mA, R_L = 100 Ω
ΔV_F	Forward Voltage Match (Note 6)		10	mV	I_F = 10 mA

NOTES:
1. These ratings are limiting values above which life or satisfactory performance may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty-cycle operation.
3. V_F is measured using an 8 ms pulse.
4. See Test circuits (Note 6) for measurement of reverse current of an individual diode.
5. I_F = 25 mA for each of the other diodes in the array.
6. For product family characteristic curves and test circuits, refer to Chapter 4, D15.

FAIRCHILD

A Schlumberger Company

1S44

General Purpose Switching Diode

- **BV . . . 50 V (MIN) @ 100 μA**
- **t_{rr} . . . 8.0 ns (MAX)**

PACKAGES

1S44 DO-35

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature Range	−65°C to +200°C
Maximum Junction Operating Temperature	+175°C
Lead Temperature	+260°C

Power Dissipation (Note 2)

Maximum Total Power Dissipation at 25°C Ambient	500 mW
Linear Power Derating Factor (from 25°C)	3.33 mW/°C

Maximum Voltage and Currents

WIV	Working Inverse Voltage	40 V
I_O	Average Rectified Current	100 mA
I_F	Continuous Forward Current	300 mA
i_f	Peak Repetitive Forward Current	400 mA
i_f (surge)	Peak Forward Surge Current	
	Pulse Width = 1 s	1.0 A
	Pulse Width = 1 μs	4.0 A

3

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
V_F	Forward Voltage	0.65 0.70	1.00 1.20	V V	I_F = 10 mA I_F = 30 mA
I_R	Reverse Current		50	nA	V_R = 10 V
BV	Breakdown Voltage	50		V	I_R = 100 μA
C	Capacitance		4.0	pF	V_R = 0, f = 1 MHz
Q_s	Stored Charge		120	pC	I_F = 10 mA, V_R = 10 V
t_{rr}	Reverse Recovery Time		8.0	ns	$I_f = I_r$ = 10 mA Recovery to 1 mA

NOTES:
1. These ratings are limiting values above which the serviceability of the diode may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty-cycle operation.
3. For product family characteristic curves, refer to Chapter 4, D4

FAIRCHILD

A Schlumberger Company

1S920/921/922/923 FDLL920/921/922/923

General Purpose Diodes

- **V_F . . . 1.2 (MAX) @ 200 mA**
- **I_R . . . 100 nA (MAX) @ RATED WIV**

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature Range	−65°C to +200°C
Maximum Junction Operating Temperature	+175°C
Lead Temperature	+260°C

Power Dissipation (Note 2)

Maximum Total Dissipation at 25°C Ambient	500 mW
Linear Derating Factor (from 25°C)	3.33 mW/°C

Maximum Voltage and Currents

		1S920	1S921	1S922	1S923
WIV	Working Inverse Voltage (−65°C to +100°C)	50 V	100 V	150 V	200 V
I_O	Average Forward Current	200 mA	200 mA	200 mA	200 mA
i_f	Recurent Peak Forward Current	600 mA	600 mA	600 mA	600 mA
$i_{f(surge)}$	Peak Forward Surge Current				
	Pulse Width = 1 s	1.0 A	1.0 A	1.0 A	1.0 A
	Pulse Width = 1 μs	4.0 A	4.0 A	4.0 A	4.0 A

PACKAGES

1S920	DO-35
1S921	DO-35
1S922	DO-35
1S923	DO-35
FDLL920	LL-34
FDLL921	LL-34
FDLL922	LL-34
FDLL923	LL-34

If you need this device in the SOT package, an electical equivalent is available. See FDSO1400 family.

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
I_R	Inverse Current		100	nA	V_R = rated WIV
			10	μA	V_R = rated WIV, T_A = 100°C
V_F	Forward Voltage		1.2	V	I_F = 200 mA
C	Capacitance		6.5	pF	V_R = 0, f = 1 MHz
Q_S	Stored Charge		12	nC	I_F = 10 mA, V_R = 10 V

NOTES:
1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty-cycle operation.
3. For product family characteristic curves, refer to Chapter 4, D1.

FAIRCHILD

A Schlumberger Company

2N697

NPN General Purpose

These transistors are designed for high-performance amplifier, oscillator and some switching applications. They perform at frequencies from dc to VHF and over more than 3 decades of current. Superior replacements offering PLANAR reliability and performance are available as the 2N1613, 2N1711 and 2N718A.

PACKAGE

2N697	TO-39

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-65° C to 200° C
Operating Junction Temperature	175° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	
25° C Ambient Temperature	0.8 W
25° C Case Temperature	3.0 W

Voltages & Currents

V_{CBO}	Collector to Base Voltage	60 V
V_{CER}	Collector to Emitter Voltage ($R_{BE} \leqslant 10\ \Omega$) (Note 4)	40 V
V_{EBO}	Emitter to Base Voltage	5.0 V

3

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
I_{CBO}	Collector Cutoff Current		1.0 100	μA μA	$V_{CB} = 30$ V, $I_E = 0$ $V_{CB} = 30$ V, $I_E = 0$ $T_A = 150°$C
h_{FE}	DC Current Gain (Note 5)	40	120		$I_C = 150$ mA, $V_{CE} = 10$ V
h_{fe}	High Frequency Current Gain	2.5			$I_C = 50$ mA, $V_{CE} = 10$ V, f = 20 mc
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage		1.5	V	$I_C = 150$ mA, $I_B = 15$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage		1.3	V	$I_C = 150$ mA, $I_B = 15$ mA
C_{ob}	Output Capacitance		35	pF	$V_{CB} = 10$ V, $I_E = 0$

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 175° C and junction-to-case thermal resistance of 75° C/W (derating factor of 13.3 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T145.

FAIRCHILD

A Schlumberger Company

2N/MPS/FTSO706
MPS/FTSO706A

NPN High Speed Logic Switches

- **V_{CER} ... 20 V (Min) @ 10 mA**
- **h_{FE} ... 20 (Min) @ 10 mA**
- **τ_s ... 60 ns (Max) 2N/MPS/FTSO706), 25 ns (Max) (MPS/FTSO706A)**
- **Complements ... MPS3640 (TO-92)**

PACKAGE

2N706	TO-118A
MPS706	TO-92
MPS706A	TO-92
FTSO706	TO-236AA/AB
FTSO706A	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures	**2N**	**MPS/FTSO**
Storage Temperature	-65° C to 175° C	-55° C to 150° C
Operating Junction Temperature	175° C	150° C

Power Dissipation (Notes 2 & 3) Total Dissipation at	**2N**	**MPS**	**FTSO**
25° C Ambient Temperature	0.3 mW	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	1.0 W	

Voltages & Currents		**706**	**706A**
V_{CBO}	Collector to Base Voltage	25 V	25V
V_{CER}	Collector to Emitter Voltage ($R_{BE} \leqslant 10\ \Omega$) (Note 4)	20 V	20 V
V_{EBO}	Emitter to Base Voltage	3.0 V	5.0 V

Electrical Characteristics (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MPS706 MIN	MPS706 MAX	706A MIN	706A MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage	15		15		V	$I_C = 10$ mA, $I_B = 0$
BV_{CER}	Collector to Emitter Breakdown Voltage	20		20		V	$I_C = 10$ mA, $R_{BE} = 10\ \Omega$
BV_{CBO}	Collector to Base Breakdown Voltage	25		25		V	$I_C = 10\ \mu$A, $I_E = 0$
I_{EBO}	Emitter Cutoff Current		10		10	μA	$V_{EB} = 3.0$ V, $I_C = 0$
I_{CBO}	Collector Cutoff Current		500		500	nA	$V_{CB} = 15$ V, $I_E = 0$
h_{FE}	DC Current Gain (Note 5)	20		20	60		$I_C = 10$ mA, $V_{CE} = 1.0$ V

NOTES:
1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 175° C and junction-to-case thermal resistance of 150° C/W (derating factor of 6.7 mW/° C) for 2N706. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C) for MPS706 and MPS706A; (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length $\leqslant 12\ \mu$s; duty cycle = 1% for MPS706, MPS706A; length = 300μs; duty cycle = 1% for 2N706.
6. For product family characteristic curves, refer to Curve Set T132 for 2N706; T162 for MPS706 and MPS706A.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MPS706 MIN	MPS706 MAX	706A MIN	706A MAX	UNITS	TEST CONDITIONS
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.6		0.6	V	$I_C = 10$ mA, $I_B = 1.0$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)		0.9	0.7	0.9	V	$I_C = 10$ mA, $I_B = 1.0$ mA
C_{ob}	Output Capacitance		6.0		6.0	pF	$V_{CB} = 10$ V, $I_E = 0$, f = 100 kHz
h_{fe}	High Frequency Current Gain	2.0		2.0			$I_C = 10$ mA, $V_{CE} = 15$ V, f = 100 MHz
r_b'	Base Resistance		50		50	Ω	$I_E = 10$ mA, $V_{CE} = 15$ V, f = 300 MHz
τ_s	Charge Storage Time Constant (test circuit no. 3111)		60		25	ns	$I_C = 10$ mA, $V_{CC} = 10$ V, $I_{B1} = I_{B2} = 10$ mA
t_{on}	Turn On Time (test circuit no. 589)		40		40	ns	$I_C = 10$ mA, $I_{B1} = 3.0$ mA, $V_{CC} = 3.0$ V
t_{off}	Turn Off Time (test circuit no. 589)		75		75	ns	$I_C = 10$ mA, $I_{B1} = 3.0$ mA, $I_{B2} = 1.5$ mA, $V_{CC} = 3.0$ V

SYMBOL	CHARACTERISTIC	2N706 MIN	2N706 MAX	UNITS	TEST CONDITIONS
BV_{CER}	Collector to Emitter Breakdown Voltage	20		V	$I_C = 10$ mA, $R_{BE} = 10$ Ω
BV_{CBO}	Collector to Base Breakdown Voltage	25		V	$I_C = 10$ μA, $I_E = 0$
I_{CBO}	Collector Cutoff Current		300	nA	$V_{CB} = 15$ V, $I_E = 0$
h_{FE}	DC Current Gain (Note 5)	20			$I_C = 10$ mA, $V_{CE} = 1.0$ V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.6	V	$I_C = 10$ mA, $I_B = 1.0$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)		0.6	V	$I_C = 10$ mA, $I_B = 1.0$ mA
C_{ob}	Output Capacitance		6.0	pF	$V_{CB} = 10$ V, $I_E = 0$, f = 100 kHz
h_{fe}	High Frequency Current Gain	2.0			$I_C = 10$ mA, $V_{CE} = 15$ V, f = 100 MHz
τ_s	Charge Storage Time Constant (test circuit no. 3111)		60	ns	$I_C = 10$ mA, $V_{CC} = 10$ V, $I_{B1} = I_{B2} = 10$ mA

FAIRCHILD

A Schlumberger Company

2N718A
2N1613

NPN Small Signal General Purpose Amplifiers

- V_{CEO} ... 32 V (Min)
- h_{FE} ... 40-120 @ 150 mA, 20 (Min) @ 500 mA

PACKAGE

2N718A	TO-18
2N1613	TO-5

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-65° to 200° C
Operating Junction Temperature	200° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	**718A**	**1613**
25° C Ambient Temperature	0.5 mW	0.8 W
100° C Ambient Temperature	1.0 mW	1.7 W
25° C Case Temperature	1.8 W	3.0 W

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage	32 V
V_{CER}	Collector to Emitter Voltage ($R_{BE} \leqslant 10\ \Omega$) (Note 4)	50 V
V_{CBO}	Collector to Base Voltage	75 V
V_{EBO}	Emitter to Base Voltage	7.0 V

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CBO}	Collector to Base Breakdown Voltage	75		V	$I_C = 0.1$ mA, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	7.0		V	$I_E = 0.1$ mA, $I_C = 0$
I_{EBO}	Emitter Current		10	nA	$V_{EB} = 5.0$ V, $I_C = 0$
I_{CBO}	Collector Cutoff Current		10	nA	$V_{CB} = 60$ V, $I_E = 0$
			10	μA	$V_{CB} = 60$ V, $I_E = 0$, $T_A = 150°$ C
h_{FE}	DC Current Gain	20			$I_C = 0.1$ mA, $V_{CE} = 10$ V
h_{FE}	DC Pulse Current Gain (Note 5)	40	120		$I_C = 150$ mA, $V_{CE} = 10$ V
		35			$I_C = 10$ mA, $V_{CE} = 10$ V
		20			$I_C = 500$ mA, $V_{CE} = 10$ V
		20			$I_C = 10$ mA, $V_{CE} = 10$ V, $T_A = -55°$ C

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 200° C and junction-to-case thermal resistance of 97.2° C (derating factor of 10.3 mW/° C); junction-to-ambient thermal resistance of 350° C/W (derating factor of 2.86 mW/° C) for 2N718A; junction-to-case thermal resistance of 58.3° C/W (derating factor of 17.2 mW/° C) junction-to-ambient thermal resistance of 219° C (derating factor of 4.56 mW/° C) for 2N1613.
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle $\leqslant$ 1%.
6. For product family characteristic curves, refer to Curve Set T145.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
$V_{CER(sus)}$	Collector to Emitter Sustaining Voltage (Note 5)	50		V	$I_C = 100$ mA (pulsed), $R_{BE} \leqslant 10\ \Omega$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		1.5	V	$I_C = 150$ mA, $I_B = 15$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)		1.3	V	$I_C = 150$ mA, $I_B = 15$ mA
C_{ob}	Output Capacitance		25	pF	$V_{CB} = 10$ V, $I_E = 0$
C_{TE}	Input Capacitance		80	pF	$V_{EB} = 0.5$ V, $I_C = 0$
h_{fe}	High Frequency Current Gain	3.0			$I_C = 50$ mA, $V_{CE} = 10$ V, f = 20 MHz
h_{fe}	Small Signal Current Gain	30 35	100 150		$I_C = 1.0$ mA, $V_{CE} = 5.0$ V, f = 1.0 kHz $I_C = 5.0$ mA, $V_{CE} = 10$ V, f = 1.0 kHz
h_{ib}	Input Resistance	24 4.0	34 8.0	Ω Ω	$I_C = 1.0$ mA, $V_{CB} = 5.0$ V, f = 1.0 kHz $I_C = 5.0$ mA, $V_{CB} = 10$ V, f = 1.0 kHz
h_{ob}	Output Conductance	0.05 0.1	0.5 1.0	μmho μmho	$I_C = 1.0$ mA, $V_{CB} = 5.0$ V, f = 1.0 kHz $I_C = 5.0$ mA, $V_{CB} = 10$ V, f = 1.0 kHz
h_{rb}	Voltage Feedback Ratio		3.0 3.0	$\times 10^{-4}$ $\times 10^{-4}$	$I_C = 1.0$ mA, $V_{CB} = 5.0$ V, f = 1.0 kHz $I_C = 5.0$ mA, $V_{CB} = 10$ V, f = 1.0 kHz
$t_d + t_r + t_f$	(test circuit no. 287)		30	ns	$I_C = 50$ mA, $V_{CC} = 20$ V
NF	Noise Figure		12	dB	$I_C = 0.3$ mA, $V_{CE} = 10$ V, f = 1.0 kHz, $R_S = 510\ \Omega$ BW = 1.0 Hz

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2N930/PN930/FTSO930

NPN Low Level Low Noise Amplifier

- **V_{CEO} ... 45 V (Min)**
- **h_{FE} ... 100-300 @ 10 mA**
- **NF ... 3.0 dB (Max) @ 1.0 kHz**

PACKAGE

2N930	TO-18
PN930	TO-92
FTSO930	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures	**PN/FTSO**	**2N**
Storage Temperature	-55° C to 150° C	-65° C to 200° C
Operating Junction Temperature	150° C	175° C

Power Dissipation (Notes 2 & 3)			
Total Dissipation at	**PN**	**2N**	**FTSO**
25° C Ambient Temperature	0.625 W	0.3 W	0.350 W*
25° C Case Temperature	1.0 W	0.6 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	45 V
V_{CBO}	Collector to Base Voltage	45 V
V_{EBO}	Emitter to Base Voltage	5.0 V
I_C	Collector Current	30 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0		V	$I_C = 0$, $I_E = 10$ nA
I_{CEO}	Collector to Emitter Cutoff Current		2.0	nA	$V_{CE} = 5.0$ V, $I_B = 0$
I_{CBO}	Collector Cutoff Current		10	nA	$V_{CB} = 45$ V, $I_E = 0$
I_{EBO}	Emitter to Base Cutoff Current		10	nA	$V_{EB} = 5.0$ V, $I_C = 0$
I_{CES}	Collector to Emitter Cutoff Current		10 10	nA μA	$V_{CE} = 45$ V, $V_{EB} = 0$ $V_{CE} = 45$ V, $V_{EB} = 0$, $T_A = 170°$ C
h_{FE}	DC Pulse Current Gain (Note 5)		600		$I_C = 10$ mA, $V_{CE} = 5.0$ V
h_{FE}	DC Current Gain	150 100 20	 300 		$I_C = 500$ μA, $V_{CE} = 5.0$ V $I_C = 10$ μA, $V_{CE} = 5.0$ V $I_C = 10$ μA, $V_{CE} = 5.0$ V, $T_A = -55°$ C

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 175° C and junction-to-case thermal resistance of 250° C/W (derating factor of 4.0 mW/° C); junction-to-ambient thermal resistance of 500° C/W (derating factor of 2.0 mW/° C) for 2N930; (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C). (TO-236) junction-to-ambient thermal resistance of 35.7° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length $\leqslant 300$ μs; duty cycle $\leqslant 2\%$.
6. For product family characteristic curves, refer to Curve Set T107.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Notes 4 & 5)	45		V	$I_C = 10$ mA, $I_B = 0$ (pulsed)
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		1.0	V	$I_C = 10$ mA, $I_B = 0.5$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)	0.6	1.0	V	$I_C = 10$ mA, $I_B = 0.5$ mA
C_{ob}	Output Capacitance		8.0	pF	$V_{CB} = 5.0$ V, $I_E = 0$
h_{fe}	Small Signal Current Gain	150	600		$I_C = 1.0$ mA, $V_{CE} = 5.0$ V, f = 1.0 kHz
h_{fe}	High Frequency Current Gain	1.0			$I_C = 500$ μA, $V_{CE} = 5.0$ V, f = 30 MHz
h_{ib}	Input Resistance	25	32	Ω	$I_C = 1.0$ mA, $V_{CB} = 5.0$ V, f = 1.0 kHz
h_{ob}	Output Conductance		1.0	µmho	$I_C = 1.0$ mA, $V_{CB} = 5.0$ V, f = 1.0 kHz
h_{rb}	Voltage Feedback Ratio		600	$x10^{-6}$	$I_C = 1.0$ mA, $V_{CB} = 5.0$ V, f = 1.0 kHz
NF	Noise Figure		3.0	dB	$I_C = 10$ μA, $V_{CE} = 5.0$ V, f = 1.0 kHz $R_S = 10$ kΩ, BW = 15.7 kHz

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2N930A/FTSO930A

NPN Low Level Low Noise Amplifier

ABSOLUTE MAXIMUM RATINGS (Note 1)

PACKAGE

2N930A	TO-18
FTSO930A	TO-236AA/AB

Temperatures

Storage Temperature	−65° C to 200° C
Operating Junction Temperature	175° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	**2N**	**FTSO**
25° C Ambient Temperature	0.5 W	0.350*
25° C Case Temperature	1.8 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	45 V
V_{CBO}	Collector to Base Voltage	60 V
V_{EBO}	Emitter to Base Voltage	6.0 V
I_C	Collector Current	30 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage (Notes 4 & 5)	45		V	$I_C = 10$ mA (pulse)
BV_{CBO}	Collector to Base Breakdown Voltage	60		V	$I_C = 10\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	6.0		V	$I_E = 10\ \mu A$, $I_C = 0$
I_{EBO}	Emitter Cutoff Current		2.0	nA	$V_{EB} = 5.0$ V, $I_C = 0$
I_{CBO}	Collector Cutoff Current		2.0	nA	$V_{CE} = 45$ V, $I_E = 0$
I_{CEO}	Collector Cutoff Current		2.0	nA	$V_{CE} = 5.0$ V, $I_B = 0$
I_{CES}	Collector Cutoff Current		2.0	nA	$V_{CE} = 45$ V, $V_{EB} = 0$
h_{FE}	DC Current Gain	150 100 60 30	 300		$I_C = 500\ \mu A$, $V_{CE} = 5.0$ V $I_C = 10\ \mu A$, $V_{CE} = 5.0$ V $I_C = 1.0\ \mu A$, $V_{CE} = 5.0$ V $I_C = 10\ \mu A$, $V_{CE} = 5.0$ V, $T_A = -55°$ C
h_{FE}	DC Pulse Current Gain (Note 5)		600		$I_C = 10$ mA, $V_{CE} = 5.0$ V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.5	V	$I_C = 10$ mA, $I_B = 0.5$ mA

NOTES:
1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 175° C and junction-to-case thermal resistance of 250° C/W (derating factor of 4.0 mW/° C); junction-to-ambient thermal resistance of 500° C/W (derating factor of 2.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length ⩽ 300 μs; duty cycle ⩽ 2%.
6. For product family characteristic curves, refer to Curve Set T107.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
$V_{BE(sat)}$	Base to Emitter Saturation Voltage) (Note 5)	0.7	0.9	V	$I_C = 10$ mA, $I_B = 0.5$ mA
C_{ob}	Output Capacitance		6.0	pF	$V_{CB} = 5.0$ V, $I_E = 0$
h_{fe}	Small Signal Current Gain	150	600		$I_C = 1.0$ mA, $V_{CE} = 5.0$ V, f = 1.0 kHz
h_{fe}	High Frequency Current Gain	1.5			$I_C = 50$ μA, $V_{CE} = 5.0$ V, f = 30 MHz
h_{ib}	Input Resistance	25	32	Ω	$I_E = 1.0$ mA, $V_{CB} = 5.0$ V, f = 1.0 kHz
h_{ob}	Output Conductance		1.0	μmhos	$I_E = 1.0$ mA, $V_{CB} = 5.0$ V, f = 1.0 kHz
h_{rb}	Voltage Feedback Ratio		600	$x10^{-6}$	$I_E = 1.0$ mA, $V_{CB} = 5.0$ V, f = 1.0 kHz
NF	Noise Figure		3.0	dB	$I_C = 10$ μA, $V_{CE} = 5.0$ V, BW = 10 cps to 10 kHz, $R_G = 10$ kΩ

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2N1132A

PNP Transistor Medium Power Voltage Speed Switch & Frequency Amplifier

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-65° to 200° C
Operating Junction Temperature	175° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	
25° C Ambient Temperature	0.6 mW
25° C Case Temperature	2.0 W
100° C Case Temperature	1.0 W
Derating Factor above 25° C	40 mW/° C min.

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	40 V
V_{CER}	Collector to Emitter Voltage $R \leqslant 10\ \Upsilon$	50 V
V_{CBO}	Collector to Base Voltage	60 V
V_{EBO}	Emitter to Base Voltage	5.0 V
I_C	Collector Current	600 mA

PACKAGE

2N1132A	TO-39

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage	40		V	$I_C = 10$ mA, $I_B = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	60		V	$I_C = 100\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0		V	$I_E = 1.0$ mA, $I_C = 0$
I_{EBO}	Emitter Cutoff Current		100	μA	$V_{EB} = 4.0$ V, $I_C = 0$
I_{CBO}	Collector Cutoff Current		0.5 50	μA μA	$V_{CB} = 45$ V, $I_E = 0$ $V_{CB} = 45$ V, $I_E = 0$, $T_A = 150°$ C
I_{CER}	Collector Cutoff Current		10	mA	$V_{CE} = 50$ V, $R_{BE} < 10\ \Omega$, $V_{CE} = 30$ V, $V_{BE} = 1.5$ V (reverse bias) $T_C = 150°$ C

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 200° C and junction-to-case thermal resistance of 58.3° C/W (derating factor of 17.2 mW/° C); junction-to-ambient thermal resistance of 292° C/W (derating factor of 3.42 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length $\leqslant$ 2% duty cycle, and $\leqslant$ 1.2 ms pulse duration.
6. For product family characteristic curves, refer to Curve Set T212.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
h_{FE}	DC Current Gain (Note 5)	30 25	90		$I_C = 150$ mA, $V_{CE} = 10$ V $I_C = 5$ mA, $V_{CE} = 10$ V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		1.5	V	$I_C = 150$ mA, $I_B = 15$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)		1.3	V	$I_C = 150$ mA, $V_{CE} = 15$ V
C_{ob}	Output Capacitance		30	pF	$V_{CB} = 10$ V, $I_E = 0$, f = 1.0 MHz
C_{ib}	Input Capacitance		80	pF	$V_{BE} = 0.5$ V, $I_C = 0$, f = 1.0 MHz
h_{fe}	AC Current Gain	25 30	75		$I_C = 1.0$ mA, $V_{CE} = 5.0$ V, f = 1.0 kHz $I_C = 5.0$ mA, $V_{CE} = 10$ V, f = 1.0 kHz
h_{fe}	High Frequency Current Gain		3.0		$I_C = 50$ mA, $V_{CE} = 10$ V, f = 20 MHz
h_{ib}	Input Impedance	25	35 10	Ω Ω	$I_C = 1.0$ mA, $V_{CE} = 5.0$ V, f = 1.0 kHz $I_C = 5.0$ mA, $V_{CE} = 10$ V, f = 1.0 kHz
h_{ob}	Output Conductance		1.0 5	μmhos μmhos	$I_C = 1.0$ mA, $V_{CE} = 5.0$ V, f = 1.0 kHz $I_C = 5.0$ mA, $V_{CE} = 10$ V, f = 1.0 kHz
h_{rb}	Voltage Feedback Ration		8.0 8.0	$\times 10^{-4}$ $\times 10^{-4}$	$I_C = 1.0$ mA, $V_{CE} = 5.0$ V, f = 1.0 kHz $I_C = 5.0$ mA, $V_{CE} = 10$ V, f = 1.0 kHz
t_{on}	Turn On Time ($t_d + t_d$)		45	ns	$I_C = 150$ mA, $I_{B1} = 15$ mA (see figure 1)
t_{off}	Turn Off Time		50	ns	$I_C = 150$ mA, $I_{B1} = 15$ mA

3

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2N1890

NPN High Voltage Amplifier & Oscillator Type

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-65° C to 200° C
Operating Junction Temperature	175° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	
25° C Ambient Temperature	0.8 W
25° C Case Temperature	3.0 W

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	60 V
V_{CER}	Collector to Emitter Voltage ($R_{BE} \leqslant 10\Omega$) (Note 4)	80 V
V_{CBO}	Collector to Base Voltage	100 V
V_{EBO}	Emitter to Base Voltage	7.0 V

PACKAGE

2N1890	TO-39

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CBO}	Collector to Base Breakdown Voltage	100		V	$I_C = 0$, $I_E = 0.1$ mA
BV_{EBO}	Emitter to Base Breakdown Voltage	7.0		V	$I_C = 0$, $I_E = 0.1$ mA
I_{CBO}	Collector Cutoff Current		10 15	nA μA	$V_{CB} = 75$ V, $I_E = 0$ $V_{CB} = 75$ V, $I_E = 0$, $T_A = 150°$ C
I_{EBO}	Emitter Cutoff Current		10	nA	$V_{EB} = 5.0$ V, $I_C = 0$
h_{FE}	DC Pulse Current Gain (Note 5)	100	300		$I_C = 150$ mA, $V_{CE} = 10$ V
h_{fe}	High Frequency Current Gain (Note 5)	3.0			$I_C = 50$ mA, $V_{CE} = 10$ V, f = 20 MHz

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 200° C and junction-to-case thermal resistance of 58.3° C/W (derating factor of 17.2 mW/° C.
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T149.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
h_{fe}	Small Signal Current Gain	50 70	200 300		$I_C = 1.0$ mA, $V_{CE} = 5.0$ V $I_C = 5.0$ mA, $V_{CE} = 10$ V
h_{ib}	Input Resistance	2.0 4.0	3.0 8.0	Ω Ω	$I_C = 1.0$ mA, $V_{CB} = 5.0$ V $I_C = 5.0$ mA, $V_{CB} = 10$ V
h_{ie}	Input Resistance	 4.0	 8.0	kΩ Ω	$I_C = 1.0$ mA, $V_{CE} = 5.0$ V $I_C = 5.0$ mA, $V_{CB} = 10$ V
h_{ob}	Output Conductance		0.3 0.3	μmho μmho	$I_C = 1.0$ mA, $V_{CB} = 5.0$ V $I_C = 5.0$ mA, $V_{CB} = 10$ V
h_{rb}	Voltage Feedback Ratio		1.50 1.50	$\times 10^{-4}$ $\times 10^{-4}$	$I_C = 1.0$ mA, $V_{CB} = 5.0$ V $I_C = 5.0$ mA, $V_{CB} = 10$ V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage		1.2 5.0	V V	$I_C = 50$ mA, $I_B = 5.0$ mA $I_C = 150$ mA, $I_B = 15$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)		0.9 1.3	V V	$I_C = 50$ mA, $I_B = 5.0$ mA $I_C = 150$ mA, $I_B = 15$ mA
$V_{CER(sus)}$	Collector to Emitter Sustaining Voltage (Note 4)	80		V	$I_C = 100$ mA (pulsed), $R_{BE} \leqslant 10\ \Omega$
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Note 5)	60		V	$I_C = 30$ mA (pulsed), $I_B = 0$
C_{obc}	Output Capacitance		15	pF	$V_{CB} = 10$ V, $I_E = 0$
C_{TE}	Emitter Transition Capacitance		85	pF	$V_{EB} = 0.5$ V, $I_C = 0$

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2N1893

NPN Small Signal General Purpose Amplifier

- **P_D ... 800 mW @ T_A = 25° C**
- **V_{CEO} ... 80 V (Min)**
- **h_{FE} ... 40-120 @ 150 mA**
- **Complements ... 2N4013 (TO-39), MPSA56 (TO-92)**

PACKAGE

2N1893 TO-39

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-65° C to 200° C
Operating Junction Temperature	175° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	
25° C Ambient Temperature	0.8 W
100° C Case Temperature	1.7 W
25° C Case Temperature	3.0 W

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	80 V
V_{CER}	Collector to Emitter Voltage ($R_{BE} \leqslant 10\Omega$) (Note 4)	100 V
V_{CBO}	Collector to Base Voltage	120 V
V_{EBO}	Emitter to Base Voltage	7.0 V

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{EBO}	Emitter to Base Breakdown Voltage	7.0		V	$I_C = 0$, $I_E = 100\ \mu A$
BV_{CBO}	Collector to Base Breakdown Voltage	120		V	$I_C = 100\ \mu A$, $I_E = 0$
I_{CBO}	Collector Cutoff Current		10 15	nA μA	$V_{CB} = 90$ V, $I_E = 0$ $V_{CB} = 90$ V, $I_E = 0$, $T_A = 150°$ C
I_{EBO}	Emitter to Base Cutoff Current		10	nA	$V_{EB} = 5.0$ V, $I_C = 0$
h_{FE}	DC Pulse Current Gain (Note 5)	40 35 20	120		$I_C = 150$ mA, $V_{CE} = 10$ V $I_C = 10$ mA, $V_{CE} = 10$ V $I_C = 10$ mA, $V_{CE} = 10$ V, $T_A = -55°$ C
h_{FE}	DC Current Gain	20			$I_C = 0.1$ mA, $V_{CE} = 10$ V

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 200° C and junction-to-case thermal resistance of 58.3° C/W (derating factor of 17.2 mW/° C); junction-to-ambient thermal resistance of 219° C/W (derating factor of 4.56 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T149.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Notes 4 & 5)	80		V	$I_C = 30$ mA (pulsed), $I_B = 0$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		1.2 5.0	V V	$I_C = 50$ mA, $I_B = 5.0$ mA $I_C = 150$ mA, $I_B = 15$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)		0.9 1.3	V V	$I_C = 50$ mA, $I_B = 5.0$ mA $I_C = 150$ mA, $I_B = 15$ mA
$V_{CER(sus)}$	Collector to Emitter Sustaining Voltage (Notes 4 & 5)		100	V	$I_C = 100$ mA (pulsed), ($R_{BE} \leqslant 10\ \Omega$)
C_{ob}	Output Capacitance		15	pF	$V_{CB} = 10$ V, $I_E = 0$
C_{ib}	Input Capacitance		85	pF	$V_{EB} = 0.5$ V, $I_E = 0$
h_{fe}	High Frequency Current Gain	2.5			$I_C = 50$ mA, $V_{CE} = 10$ V, f = 20 MHz
h_{fe}	Small Signal Current Gain	30 45	100		$I_C = 1.0$ mA, $V_{CE} = 5.0$ V, f = 1.0 kHz $I_C = 5.0$ mA, $V_{CE} = 10$ V, f = 1.0 kHz
h_{ib}	Input Resistance	20 4.0	30 8.0	Ω Ω	$I_C = 1.0$ mA, $V_{CB} = 5.0$ V, f = 1.0 kHz $I_C = 5.0$ mA, $V_{CB} = 10$ V, f = 1.0 kHz
h_{ob}	Output Conductance		0.5 0.5	μmho μmho	$I_C = 1.0$ mA, $V_{CE} = 5.0$ V, f = 1.0 kHz $I_C = 5.0$ mA, $V_{CE} = 10$ V, f = 1.0 kHz
h_{rb}	Voltage Feedback Ratio		1.25 1.50	$\times 10^{-4}$ $\times 10^{-4}$	$I_C = 1.0$ mA, $V_{CB} = 5.0$ V, f = 1.0 kHz $I_C = 5.0$ mA, $V_{CB} = 10$ V, f = 1.0 kHz

3

FAIRCHILD

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2N/PN/FTSO2218
2N/PN/FTSO2221

NPN Small Signal General Purpose Amplifiers & Switches

- V_{CEO} . . . 30 V (Min)

PACKAGE

2N2218	TO-39
2N2221	TO-18
PN2218	TO-92
PN2221	TO-92
FTSO2218	TO-236AA/AB
FTSO2221	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures	**2N**	**PN/FTSO**
Storage Temperature	-65° C to 200° C	-55° C to 150° C
Operating Junction Temperature	175° C	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	**2N2218**	**2N2221**
25° C Ambient Temperature	0.8 mW	0.5 W
25° C Case Temperature	3.0 W	1.8 W

Total Dissipation at	**PN2218**	**FTSO**
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	30 V
V_{CBO}	Collector to Base Voltage	60 V
V_{EBO}	Emitter to Base Voltage	5.0 V
I_C	Collector Current	800 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CBO}	Collector to Base Breakdown Voltage	60		V	$I_C = 10\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0		V	$I_E = 10\ \mu A$, $I_C = 0$
I_{EBO}	Emitter Cutoff Current		10	nA	$V_{EB} = 3.0$ V, $I_C = 0$
I_{CBO}	Collector Cutoff Current		10 10	nA μA	$V_{CB} = 50$ V, $I_E = 01$ $V_{CB} = 50$ V, $I_E = 0$, $T_A = 150°$ C

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 175° C; function-to-case thermal resistance of 50° C/W (derating factor of 20 mW/° C), and junction-to-ambient thermal resistance of 188° C/W (derating factor of 5.33 wW/° C) for 2N2218; for 2N2221, junction-to-case thermal resistance of 83.5° C/W (derating factor of 12 mW/° C); junction-to-ambient thermal resistance of 300° C/W (derating factor of 3.33 mW/° C). These ratings give a maximum junction temperature of 150° C, junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C) for PN2218 and PN2221; (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle $\leqslant$ 2%.
6. For product family characteristic curves, refer to Curve Set T145.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
h_{FE}	DC Current Gain (Note 5)	40 20 35 25 20 20	120		$I_C = 150$ mA, $V_{CE} = 10$ V $I_C = 150$ mA, $V_{CE} = 1.0$ V $I_C = 10$ mA, $V_{CE} = 10$ V $I_C = 1.0$ mA, $V_{CE} = 10$ V $I_C = 0.1$ mA, $V_{CE} = 10$ V $I_C = 500$ mA, $V_{CE} = 10$ V
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Note 5)	30		V	$I_C = 10$ mA (pulsed), $I_B = 0$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.4 1.6	V V	$I_C = 150$ mA, $I_B = 50$ mA $I_C = 500$ mA, $I_B = 50$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)		1.3 2.6	V V	$I_C = 150$ mA, $I_B = 15$ mA $I_C = 500$ mA, $I_B = 50$ mA
C_{ob}	Output Capacitance		8.0	pF	$V_{CB} = 10$ V, $I_E = 0$
h_{fe}	High Frequency Current Gain	2.5			$I_C = 20$ mA, $V_{CE} = 20$ V, f = 100 MHz
$R_e(h_{ie})$	Real Part of Common Emitter High Frequency Input Impedance		60	Ω	$I_C = 20$ mA, $V_{CE} = 20$ V, f = 300 MHz

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2N/PN/FTSO2218A
2N/PN/FTSO2221A

NPN Small Signal General Purpose Amplifiers & Switches

- **V_{CEO} . . . 40 V (Min) @ 10 mA**
- **h_{FE} . . . 40-120 @ 150 mA**
- **t_{on} . . . 35 ns (Max) @ 150 mA, t_{off} . . . 285 ns (Max) @ 150 mA**
- **Complements . . . 2N/PN/FTSO2904A Series**

PACKAGE

2N2218A	TO-39
2N2221A	TO-18
PN2218A	TO-92
PN2221A	TO-92
FTSO2218A	TO-236AA/AB
FTSO2221A	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures	**2N**	**PN/FTSO**
Storage Temperature	−65° C to 200° C	−55° C to 150° C
Operating Junction Temperature	175° C	150° C

Power Dissipation (Notes 2 & 3)		
Total Dissipation at	**2218A**	**2221A**
25° C Ambient Temperature (Note 7)	0.8 W	0.5 W
25° C Case Temperature	3.0 W	1.8 W

Total Dissipation at	**PN**	**FTSO**
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents		
V_{CEO}	Collector to Emitter Voltage (Note 4)	40 V
V_{CBO}	Collector to Base Voltage	75 V
V_{EBO}	Emitter to Base Voltage	6.0 V
I_C	Collector Current	800 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage (Note 5)	40		V	$I_C = 10$ mA, $I_B = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	6.0		V	$I_C = 0$, $I_E = 10\ \mu A$
BV_{CBO}	Collector to Base Breakdown Voltage	75		V	$I_C = 10\ \mu A$, $I_C = 0$

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 175° C, junction-to-case thermal resistance of 50° C/W (derating factor of 20 mW/° C and junction-to-ambient thermal resistance of 188° C/W (derating factor of 5.33 mW/° C) for 2N2218A. For the 2N2221A, junction-to-case thermal resistance of 83.5° C/W (derating factor of 12 mW/° C), junction-to-ambient thermal resistance of 300° C/W (derating factor of 3.33 mW/° C). These ratings give a maximum junction temperature of 150° C, junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); and junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C) for PN2218A and PN2221A. For FTSO2218A and FTSO2221A junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T145.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
I_{CEX}	Collector Reverse Current		10	nA	$V_{CE} = 60$ V, $V_{EB} = 3.0$ V
I_{CBO}	Collector Reverse Current		10 10	nA μA	$V_{CB} = 60$ V, $I_E = 0$ $V_{CB} = 60$ V, $I_E = 0$, $T_A = 150°$C
I_{EBO}	Emitter to Base Cutoff Current		10	nA	$V_{EB} = 3.0$ V, $I_C = 0$
I_{BL}	Base Current		20	nA	$V_{EB} = 3.0$ V, $V_{CE} = 60$ V
h_{FE}	DC Current Gain (Note 5) (Note 5) (Note 5) (Note 5) (Note 5)	20 25 35 40 25 15 20	 120		$I_C = 100$ μA, $V_{CE} = 10$ V $I_C = 1.0$ mA, $V_{CE} = 10$ V $I_C = 10$ mA, $V_{CE} = 10$ V $I_C = 150$ mA, $V_{CE} = 10$ V $I_C = 500$ mA, $V_{CE} = 10$ V $I_C = 10$ mA, $V_{CE} = 10$ V, $T_A = -55°$C $I_C = 150$ mA, $V_{CE} = 1.0$ V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.3 1.0	V V	$I_C = 150$ mA, $I_B = 15$ mA $I_C = 500$ mA, $I_B = 50$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)	0.6	1.2 2.0	V V	$I_C = 150$ mA, $I_B = 15$ mA $I_C = 500$ mA, $I_B = 50$ mA
C_{ob}	Output Capacitance		8.0	pF	$V_{CB} = 10$ V, $I_E = 0$, f = 100 kHz
C_{ib}	Input Capacitance		25	pF	$V_{EB} = 0.5$ V, $I_C = 0$, f = 100 kHz
h_{fe}	High Frequency Current Gain	2.5			$I_C = 20$ mA, $V_{CE} = 5.0$ V, f = 100 MHz
h_{fe}	Small Signal Current Gain	30 50	150 300		$I_C = 1.0$ mA, $V_{CB} = 10$ V, f = 1.0 kHz $I_C = 10$ mA, $V_{CB} = 10$ V, f = 1.0 kHz
h_{ie}	Input Resistance	1.0 0.2	3.5 1.0	kΩ kΩ	$I_C = 1.0$ mA, $V_{CB} = 10$ V, f = 1.0 kHz $I_C = 10$ mA, $V_{CB} = 10$ V, f = 1.0 kHz
h_{oe}	Output Conductance	3.0 10	15 100	μmho μmho	$I_C = 1.0$ mA, $V_{CE} = 10$ V, f = 1.0 kHz $I_C = 10$ mA, $V_{VB} = 10$ V, f = 1.0 kHz
h_{re}	Voltage Feedback Ratio		500 250	$x10^{-6}$ $x10^{-6}$	$I_C = 1.0$ mA, $V_{CB} = 10$ V, f = 1.0 kHz $I_C = 10$ mA, $V_{CB} = 10$ V, f = 1.0 kHz
R_E (h_{ie})	Real Part of Common Emitter High Frequency Input Impedance	60		Ω	$I_C = 20$ mA, $V_{CE} = 20$ V f = 300 MHz
t_d	Turn On Delay Time (test circuit no. 231)		10	ns	$I_{CS} = 150$ mA, $V_{CC} = 30$ V, $I_{B1} = 15$ mA
t_r	Rise Time (test circuit no. 231)		25	ns	$I_{CS} = 150$ mA, $V_{CC} = 30$ V, $I_{B1} = 15$ mA
t_s	Storage Time (test circuit no. 232)		225	ns	$I_C = 150$ mA, $V_{CC} = 30$ V, $I_{B1} = I_{B2} = 15$ mA
t_f	Fall Time (test circuit no. 232)		60	ns	$I_{CS} = 150$ mA, $V_{CC} = 30$ V, $I_{B1} = I_{B2} = 15$ mA
T_A	Active Region Time Constant		2.5	ns	$I_C = 150$ mA, $V_{CE} = 30$ V
$r_b'C_c$	Collector to Base Time Constant		150	ps	$I_C = 20$ mA, $V_{CE} = 20$ V, f = 31.8 MHz

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2N2219/PN2219/FTSO2219
2N2222/PN2222/FTSO2222

NPN Small Signal General Purpose Amplifiers & Switches

- V_{CEO} ... **30 V (Min)**
- h_{FE} ... **100-300 @ 150 mA, 30 (Min) @ 500 mA**

PACKAGE

2N2219	TO-39
2N2222	TO-18
PN2219	TO-92
PN2222	TO-92
FTSO2219	TO-236AA/AB
FTSO2222	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures	**2N**	**PN/FTSO**
Storage Temperature	-65° C to 200° C	-55° C to 150° C
Operating Junction Temperature	175° C	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	**2N2219**	**2N2222**
25° C Ambient Temperature	0.8 mW	0.5 W
25° C Case Temperature	3.0 W	1.8 W

Total Dissipation at	**PN2219**	**FTSO**
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	30 V
V_{CBO}	Collector to Base Voltage	60 V
V_{EBO}	Emitter to Base Voltage	5.0 V
I_C	Collector Current	800 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CBO}	Collector to Base Breakdown Voltage	60		V	$I_C = 10\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0		V	$I_E = 10\ \mu A$, $I_C = 0$
I_{EBO}	Emitter Cutoff Current		10	nA	$V_{EB} = 3.0$ V, $I_C = 0$
I_{CBO}	Collector Cutoff Current		10 10	nA μA	$V_{CB} = 50$ V, $I_E = 0$ $V_{CB} = 50$ V, $I_E = 0$, $T_A = 150°$ C

NOTES:
1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 175° C; function-to-case thermal resistance of 50° C/W (derating factor of 20 mW/° C), and junction-to-ambient thermal resistance of 188° C/W (derating factor of 5.33 wW/° C) for 2N2219; for 2N2222, junction-to-case thermal resistance of 83.5° C/W (derating factor of 12 mW/° C); junction-to-ambient thermal resistance of 300° C/W (derating factor of 3.33 mW/° C). These ratings give a maximum junction temperature of 150° C, junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C) for PN2219 and PN2222; (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle $\leqslant$ 2%.
6. For product family characteristic curves, refer to Curve Set T145.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
h_{FE}	DC Current Gain (Note 5)	100 50 75 50 35 30	300		$I_C = 150$ mA, $V_{CE} = 10$ V $I_C = 150$ mA, $V_{CE} = 1.0$ V $I_C = 10$ mA, $V_{CE} = 10$ V $I_C = 0.1$ mA, $V_{CE} = 10$ V $I_C = 0.1$ mA, $V_{CE} = 10$ V $I_C = 500$ mA, $V_{CE} = 10$ V
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Note 5)	30		V	$I_C = 10$ mA (pulsed), $I_B = 0$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.4 1.6	V V	$I_C = 150$ mA, $I_B = 50$ mA $I_C = 500$ mA, $I_B = 50$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)		1.3 2.6	V V	$I_C = 150$ mA, $I_B = 15$ mA $I_C = 500$ mA, $I_B = 50$ mA
C_{ob}	Output Capacitance		8.0	pF	$V_{CB} = 10$ V, $I_E = 0$
h_{fe}	High Frequency Current Gain	2.5			$I_C = 20$ mA, $V_{CE} = 20$ V, f = 100 MHz
$R_e(h_{ie})$	Real Part of Common Emitter High Frequency Input Impedance		60	Ω	$I_C = 20$ mA, $V_{CE} = 20$ V, f = 300 MHz

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2N/PN/FTSO/2219A
2N/PN/FTSO2222A

NPN Small Signal General Purpose Amplifiers & Switches

- V_{CEO} ... **40 V (Min) @ 10 mA**
- h_{FE} ... **100-300 (2N/PN/FTSO2219A, 2N/PN/FTSO2222A) @ 150 mA**
- t_{on} ... **35 ns (Max) @ 150 mA,** t_{off} ... **285 ns (Max) @ 150 mA**
- **Complements ... 2N/PN/FTSO2904A Series**

PACKAGE

2N2219A	TO-39
2N2222A	TO-39
PN2219A	TO-92
PN2222A	TO-92
FTSO2219A	TO-236AA/AB
FTSO2222A	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures	**2N**	**PN/FTSO**
Storage Temperature	−65° C to 200° C	−55° C to 150° C
Operating Junction Temperature	175° C	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	**2N2219A**	**2N2222A**
25° C Ambient Temperature (Note 7)	0.8 W	0.5 W
25° C Case Temperature	3.0 W	1.8 W

	PN	**FTSO**
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	40 V
V_{CBO}	Collector to Base Voltage	75 V
V_{EBO}	Emitter to Base Voltage	6.0 V
I_C	Collector Current	800 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage (Note 5)	40		V	$I_C = 10$ mA, $I_B = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	6.0		V	$I_C = 0$, $I_E = 10\ \mu A$
BV_{CBO}	Collector to Base Breakdown Voltage	75		V	$I_C = 10\ \mu A$, $I_C = 0$
I_{CEX}	Collector Reverse Current		10	nA	$V_{CE} = 60$ V, $V_{EB} = 3.0$ V

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 175° C, junction-to-case thermal resistance of 50° C/W (derating factor of 20 mW/° C), and junction-to-ambient thermal resistance of 188° C/W (derating factor of 5.33 mW/° C) for 2219A. For the 2N2222A, junction-to-case thermal resistance of 83.5° C/W (derating factor of 12 mW/° C), junction-to-ambient thermal resistance of 300° C/W (derating factor of 3.33 mW/° C). These ratings give a maximum junction temperature of 150° C, junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C) for PN2219A, PN2222A. For the FTSO2219A/2222A, these ratings give a maximum junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T145.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
I_{CBO}	Collector Reverse Current		10 10	nA μA	V_{CB} = 60 V, I_E = 0 V_{CB} = 60 V, I_E = 0, T_A = 150° C
I_{EBO}	Emitter to Base Cutoff Current		10	nA	V_{EB} = 3.0 V, I_C = 0
I_{BL}	Base Current		20	nA	V_{EB} = 3.0 V, V_{CE} = 60 V
h_{FE}	DC Current Gain (Note 5) (Note 5) (Note 5) (Note 5) (Note 5)	35 50 75 100 40 35 50	 300		I_C = 100 μA, V_{CE} = 10 V I_C = 1.0 mA, V_{CE} = 10 V I_C = 10 mA, V_{CE} = 10 V I_C = 150 mA, V_{CE} = 10 V I_C = 500 mA, V_{CE} = 10 V I_C = 10 mA, V_{CE} = 10 V, T_A = −55° C I_C = 150 mA, V_{CE} = 1.0 V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.3 1.0	V V	I_C = 150 mA, I_B = 15 mA I_C = 500 mA, I_B = 50 mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)	0.6	1.2 2.0	V V	I_C = 150 mA, I_B = 15 mA I_C = 500 mA, I_B = 50 mA
C_{ob}	Output Capacitance		8.0	pF	V_{CB} = 10 V, I_E = 0, f = 100 kHz
C_{ib}	Input Capacitance		25	pF	V_{EB} = 0.5 V, I_C = 0, f = 100 kHz
h_{fe}	High Frequency Current Gain	3.0			I_C = 20 mA, V_{CE} = 5.0 V, f = 100 MHz
h_{fe}	Small Signal Current Gain	50 75	300 375		I_C = 1.0 mA, V_{CB} = 10 V, f = 1.0 kHz I_C = 10 mA, V_{CB} = 10 V, f = 1.0 kHz
h_{ie}	Input Resistance	2.0 0.25	8.0 1.25	kΩ kΩ	I_C = 1.0 mA, V_{CB} = 10 V, f = 1.0 kHz I_C = 10 mA, V_{CB} = 10 V, f = 1.0 kHz
h_{oe}	Output Conductance	5.0 25	35 200	μmho μmho	I_C = 1.0 mA, V_{CE} = 10 V, f = 1.0 kHz I_C = 10 mA, V_{CE} = 10 V, f = 1.0 kHz
h_{re}	Voltage Feedback Ratio		800 400	$x10^{-6}$ $x10^{-6}$	I_C = 1.0 mA, V_{CB} = 10 V, f = 1.0 kHz I_C = 10 mA, V_{CB} = 10 V, f = 1.0 kHz
R_E (h_{ie})	Real Part of Common Emitter Frequency Input Impedance	60		Ω	I_C = 20 mA, V_{CE} = 20 V f = 300 MHz
t_d	Turn On Delay Time (test circuit no. 231)		10	ns	I_{CS} = 150 mA, V_{CC} = 30 V, I_{B1} = 15 mA
t_r	Rise Time (test circuit no. 231)		25	ns	I_{CS} = 150 mA, V_{CC} = 30 V, I_{B1} = 15 mA
t_s	Storage Time (test circuit no. 232)		225	ns	I_{CS} = 150 mA, V_{CC} = 30 V, I_{B1} = I_{B2} = 15 mA
t_f	Fall Time (test circuit no. 232)		60	ns	I_{CS} = 150 mA, V_{CC} = 30 V, I_{B1} = I_{B2} = 15 mA
T_A	Active Region Time Constant		2.5	ns	I_C = 150 mA, V_{CE} = 30 V
$r_b'C_c$	Collector to Base Time Constant		150	ps	I_C = 20 mA, V_{CE} = 20 V, f = 31.8 MHz
NF	Noise Figure		4.0	dB	I_C = 100 μA, V_{CE} = 10 V, R_G = 1.0 kΩ, BW = 1.0 Hz, f = 1.0 kHz

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2N2270

NPN Low Noise Medium Power Transistor

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-65° C to 200° C
Operating Junction Temperature	-65° C to 200° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	
25° C Ambient Temperature	1.0 W
25° C Case Temperature	5.0 W

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	45 V
V_{CBO}	Collector to Base Voltage (with Emitter Open)	60 V
V_{CER}	Collector to Base Voltage ($R_{BE} \leqslant 10\ \Omega$)	60 V
V_{EBO}	Emitter to Base Voltage	7.0 V
I_C	Collector Current	1 A

PACKAGE

2N2270	TO-39

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 5)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CBO}	Collector to Base Breakdown Voltage	60		V	$I_C = 0.05\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	7		V	$I_E = 100\ \mu A$, $I_C = 0$
LV_{CEO}	Collector to Emitter Sustaining Voltage (Note 1)	45		V	$I_C = 100$ mA, $I_B = 0$ (pulsed)
LV_{CER}	Collector to Emitter Sustaining Voltage	60		V	$I_C = 100$ mA, $R_{BE} = 10\ \Omega$ (pulsed)
I_{EBO}	Emitter Cutoff Current		100	nA	$V_{EB} = 5.0$ V, $I_C = 0$
I_{CBO}	Collector Cutoff Current (150° C)		50 50	nA μA	$V_{CB} = 60$ V, $I_E = 0$ $V_{CB} = 60$ V, $I_E = 0$, $T_A = 150°$ C
h_{FE}	DC Pulse Current Gain (Note 2)	5 30	200		$I_C = 150$ mA, $V_{CE} = 10$ V $I_C = 1.0$ mA, $V_{CE} = 10$ V

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. Pulse conditions: length = 300 μs; duty cycle = 1.8%.
3. These ratings give a maximum junction temperature of 150° C and junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. For product family characteristic curves, refer to Curve Set T145.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 5)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage		0.9	V	$I_C = 150$ mA, $I_B = 15$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage		1.2	V	$I_C = 150$ mA, $I_B = 15$ mA
C_{ob}	Output Capacitance		15	pF	$V_{CB} = 10$ V, $I_E = 0$
C_{ib}	Input Capacitance		80	pF	$V_{EB} = 0.5$ V, $I_C = 0$
h_{fe}	Small Signal Current Gain	50 5	275		$I_C = 5.0$ mA, $V_{CE} = 10$ V, f = 1.0 kc $I_C = 50$ mA, $V_{CE} = 10$ V, f = 20 mc
f_T	Current Gain Bandwidth Product		100	MHz	$I_C = 50$ mA, $V_{CE} = 10$ V
$t_d+t_r+t_s+t_f$	Switching Time		30	ns	
NF	Broad Band Noise Figure		10	dB	$I_C = 300$ μA, $V_{CE} = 10$ V, f = 1.0 kHz, $R_S = 1000$ Ω, BW = 15 kHz

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2N/PN/MPS/FTSO2369
2N/PN/MPS/FTSO2369A
2N/FTSO5769

NPN High Speed Saturated Switches

- **V_{CEO} . . . 15 V (Min)**
- **t_s . . . 13 ns (Max) @ 10 mA**
- **t_{on} . . . 12 ns (Max) @ 10 mA, t_{off} . . . 18 ns (Max) @ 10 mA**
- **Complements . . . 2N4209 (TO18), 2N5771 (TO92)**

PACKAGE

2N2369	TO-18
2N2369A	TO-18
2N5769	TO-92
PN2369	TO-92
PN2369A	TO-92
MPS2369	TO-92
MPS2369A	TO-92
FTSO2369	TO-236AA/AB
FTSO2369A	TO-236AA/AB
FTSO5769	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures	**2N2369/69A**	**MPS/PN2369/A FTSO2369/69A 2N/FTSO5769**
Storage Temperature	-65° C to 200° C	-55° C to 150° C
Operating Junction Temperature	200° C	150° C

Power Dissipation (Notes 2 & 3) Total Dissipation at	**2N2369/A**	**2N5769 PN/MPS**	**FTSO**
25° C Ambient Temperature	0.36 W	0.625 W	0.350 W*
100° C Case Temperature	0.68 W	0.260 W	
25° C Case Temperature	1.2 W	1.0 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	15 V
V_{CBO}	Collector to Base Voltage	40 V
V_{CES}	Collector to Emitter Voltage	40 V
V_{EBO}	Emitter to Base Voltage	4.5 V
I_C	Collector Current	200 mA
	(Pulse = 10 μs)	500 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	2369 MIN	2369 MAX	2369A 5769 MIN	2369A 5769 MAX	UNITS	TEST CONDITIONS
BV_{CES}	Collector to Emitter Breakdown Voltage	40		40		V	$I_C = 10\ \mu A$, $V_{BE} = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	40		40		V	$I_C = 10\ \mu A$, $V_{BE} = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	4.5		4.5		V	$I_E = 10\ \mu A$, $I_C = 0$

NOTES:
1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 200° C and junction-to-case thermal resistance of 146° C/W (derating factor of 6.85 mW/° C); junction-to-ambient thermal resistance of 486° C/W (derating factor of 2.06 mW/° C) for 2N2369, 2N2369A, PN2369 and PN2369A. These ratings give a maximum junction temperature of 150° C and junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C) for MPS2369 and 2N5769; (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle $\leqslant$ 2%.
6. For product family characteristic curves, refer to Curve Set T132.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	2369 MIN	2369 MAX	2369A 5769 MIN	2369A 5769 MAX	UNITS	TEST CONDITIONS
I_{CBO}	Collector Cutoff Current		400		400	nA	$V_{CB} = 20$ V, $I_E = 0$
			30		30	μA	$V_{CB} = 20$ V, $I_E = 0$, $T_A = 150°$ C
h_{FE}	DC Pulse Current Gain (Note 5)	40	120				$I_C = 10$ mA, $V_{CE} = 1.0$ V
		20					$I_C = 100$ mA, $V_{CE} = 2.0$ V
				40	120		$I_C = 10$ mA, $V_{CE} = 0.35$ V
				30			$I_C = 30$ mA, $V_{CE} = 0.4$ V
				20			$I_C = 100$ mA, $V_{CE} = 1.0$ V
		20					$I_C = 10$ mA, $V_{CE} = 1.0$ V, $T_A = -55°$ C
				20			$I_C = 10$ mA, $V_{CE} = 0.35$ V, $T_A = -55°$ C
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Notes 4 & 5)	15		15		V	$I_C = 10$ mA (pulsed), $I_B = 0$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.25			V	$I_C = 10$ mA, $I_B = 1.0$ mA
					0.2	V	$I_C = 10$ mA, $I_B = 1.0$ mA
					0.25	V	$I_C = 30$ mA, $I_B = 3.0$ mA
					0.5	V	$I_C = 100$ mA, $I_B = 10$ mA
					0.3	V	$I_C = 10$ mA, $I_B = 10$ mA, $T_A = 125°$ C
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)	0.70	0.85	0.70	0.85	V	$I_C = 10$ mA, $I_B = 1.0$ mA
C_{ob}	Output Capacitance		4.0		4.0	pF	$V_{CB} = 5.0$ V, $I_E = 0$, f = 140 kHz
h_{fe}	High Frequency Current Gain	5.0		5.0			$I_C = 10$ mA, $V_{CE} = 10$ V, f = 100 MHz
τ_s	Charge Storage Time Constant (test circuit no. 3111)		13		13	ns	$I_C = 10$ mA, $I_{B1} = I_{B2} = 10$ mA, $V_{CC} = 10$ V
t_{on}	Turn On Time (test circuit no. 210)		12		12	ns	$I_C = 10$ mA, $I_{B1} = 3.0$ mA, $V_{CC} = 3.0$ V
t_{off}	Turn Off Time (test circuit no. 210)		18		18	ns	$I_C = 10$ mA, $I_{B1} = 3.0$ mA, $I_{B2} = -1.5$ mA, $V_{CC} = 3.0$ V

SYMBOL	CHARACTERISTIC	MPS2369 MIN	MPS2369 MAX	UNITS	TEST CONDITIONS
BV_{CES}	Collector to Emitter Breakdown Voltage	40		V	$I_C = 10$ μA, $V_{BE} = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	40		V	$I_C = 10$ μA, $V_{BE} = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	4.5		V	$I_E = 10$ μA, $I_C = 0$
I_{CBO}	Collector Cutoff Current		400	nA	$V_{CB} = 20$ V, $I_E = 0$, $T_A = 150°$ C
I_{CES}	Collector Cutoff Current		30	μA	$V_{CB} = 20$ V, $I_E = 0$, $T_A = 125°$ C

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MPS2369 MIN	MPS2369 MAX	UNITS	TEST CONDITIONS
h_{FE}	DC Pulse Current Gain (Note 5)	40 20 20	120		$I_C = 10$ mA, $V_{CE} = 1.0$ V $I_C = 100$ mA, $V_{CE} = 2.0$ V $I_C = 10$ mA, $V_{CE} = 1.0$ V, $T_A = -55°$ C
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Notes 4 & 5)	15		V	$I_C = 10$ mA (pulsed), $I_B = 0$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.25	V	$I_C = 10$ mA, $I_B = 1.0$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)	0.70	0.85	V	$I_C = 10$ mA, $I_B = 1.0$ mA
C_{ob}	Output Capacitance		4.0	pF	$V_{CB} = 5.0$ V, $I_E = 0$, f = 140 kHz
h_{fe}	High Frequency Current Gain	5.0			$I_C = 10$ mA, $V_{CE} = 10$ V, f = 100 MHz
τ_s	Charge Storage Time Constant (test circuit no. 3111)		13	ns	$I_C = 10$ mA, $I_{B1} = I_{B2} = 10$ mA, $V_{CC} = 10$ V
t_{on}	Turn On Time (test circuit no. 210)		12	ns	$I_C = 10$ mA, $I_{B1} = 3.0$ mA, $V_{CC} = 3.0$ V
t_{off}	Turn Off Time (test circuit no. 210)		18	ns	$I_C = 10$ mA, $I_{B1} = 3,0$ mA, $I_{B2} = -1.5$ mA, $V_{CC} = 3.0$ V

FAIRCHILD

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2N2405

NPN Low Power Audio Frequency Transistor

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-65° C to 200° C
Operating Junction Temperature	175° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	
25° C Ambient Temperature	1.0 W
25° C Case Temperature	5.0 W

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	90 V
V_{CBO}	Collector to Base Voltage	140 V
V_{EBO}	Emitter to Base Voltage	7.0 V
I_C	Collector Current	1.0 A

PACKAGE

2N2405	TO-39

3

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CER}	Collector to Emitter Breakdown Voltage	140		V	$I_C = 100$ mA, $R_{BE} = 10\ \Omega$
BV_{CBO}	Collector to Base Breakdown Voltage	120		V	$I_C = 100\ \mu$A, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	7.0		V	$I_E = 100\ \mu$A, $I_C = 0$
I_{EBO}	Emitter Cutoff Current		10	nA	$V_{EB} = 5.0$ V
I_{CBO}	Collector Cutoff Current		10 10	nA μA	$V_{CB} = 90$ V $V_{CB} = 90$ V, $I_E = 0$, $T_A = 150°$ C
LV_{CEO}	Collector to Emitter Sustain Voltage	90 90		V V	$I_C = 30$ mA $I_C = 100$ mA
h_{FE}	DC Pulse Current Gain (Note 5)	60	200		$I_C = 150$ mA, $V_{CE} = 10$ V
h_{FE}	DC Current Gain (Note 5)	35			$I_C = 10$ mA, $V_{CE} = 10$ V

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 175°C and junction-to-case thermal resistance of 30°C/W (derating factor of 3.33 mW/° C); junction-to-ambient thermal resistance of 150° C/W (derating factor of 6.6 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1.8%.
6. For product family characteristic curves, refer to Curve Set T149.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage		0.5	V	$I_C = 150$ mA, $I_B = 15$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage		1.1	V	$I_C = 150$ mA, $I_B = 15$ mA
C_{ob}	Output Capacitance		15	pF	$V_{CB} = 10$ V, $I_E = 0$, f = 1.0 MHz
C_{ib}	Input Capacitance		80	pF	$V_{EB} = 0.5$ V, $I_C = 0$
h_{fe}	Current Gain	50	275		$I_C = 5.0$ mA, $V_{CE} = 5.0$ V, f = 1.0 kHz
h_{ib}	Input Resistance	4	8	Ω	$I_C = 5.0$ mA, $V_{CE} = 10$ V, f = 1.0 kHz
h_{ob}	Output Conductance		0.5	μmhos	$I_C = 5.0$ mA, $V_{CB} = 10$ V, f = 1.0 kHz
h_{rb}	Voltage Feedback Ratio		3	$x10^{-4}$	$I_C = 5.0$ mA, $V_{CB} = 10$ V, f = 1.0 kHz

FAIRCHILD

A Schlumberger Company

2N2484/FTSO2484
PN2484
2N3117/FTSO3117

NPN Low Level Low Noise Amplifiers

- **V_{CEO} ... 60 V (Min)**
- **h_{FE} ... 100-500 (2N/PN/FTSO2484), 250-500 (2N/FTSO3117) @ 10 μA**
- **NF ... 3.0 dB (Max) (2N/PN/FTSO2484), 1.0 dB (Max) (2N/FTSO3117) @ 1.0 kHz, 2.0 dB (Max) (2N/PN/FTSO2484), 1.0 dB (Max) (2N/FTSO3117) @ 10 kHz**

PACKAGE	
2N2484	TO-18
2N3117	TO-18
PN2484	TO-92
FTSO2484	TO-236AA/AB
FTSO3117	TO-236AA/AB

3

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures	**2N3117**	**PN/FTSO**	**2N2484**
Storage Temperature	-65° C to 200° C	-55° C to 150° C	-65° C to 300° C
Operating Junction Temperature	200° C	150° C	200° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	**2N**	**PN**
25° C Ambient Temperature	0.36 mW	0.625 W
25° C Case Temperature	1.2 W	1.0 W
Total Dissipation at	**FTSO**	
25° C Ambient Temperature	0.350 W*	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	60 V
V_{CBO}	Collector to Base Voltage	60 V
V_{EBO}	Emitter to Base Voltage	6.0 V
I_C	Collector Current	50 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	2484 MIN	2484 MAX	3117 MIN	3117 MAX	UNITS	TEST CONDITIONS
BV_{CBO}	Collector to Base Breakdown Voltage	60		60		V	$I_C = 10\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	6.0		6.0		V	$I_E = 10\ \mu A$, $I_C = 0$
I_{CEO}	Collector to Emitter Cutoff Current		2.0			nA	$V_{CE} = 5.0$ V, $I_B = 0$
I_{EBO}	Emitter Cutoff Current		10		10	nA	$V_{EB} = 5.0$ V, $I_C = 0$
I_{CBO}	Collector Cutoff Current		10 10		10 10	nA μA	$V_{CB} = 45$ V, $I_E = 0$ $V_{CB} = 45$ V, $I_E = 0$, $T_A = 150°$ C

NOTES:
1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 200° C and junction-to-case thermal resistance of 147° C/W (derating factor of 6.85 mW/° C); junction-to-ambient thermal resistance of 485° C/W (derating factor of 2.06 mW/° C) for 2N2484 and 2N3117. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T107.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	2484 MIN	2484 MAX	3117 MIN	3117 MAX	UNITS	TEST CONDITIONS
h_{FE}	DC Current Gain (Note 5)		800				$I_C = 10$ mA, $V_{CE} = 5.0$ V
		250		400			$I_C = 1.0$ mA, $V_{CE} = 5.0$ V
		200					$I_C = 500$ μA, $V_{CE} = 5.0$ V
		175		300			$I_C = 100$ μA, $V_{CE} = 5.0$ V
		100	500	250	500		$I_C = 10$ μA, $V_{CE} = 5.0$ V
		30		100			$I_C = 1.0$ μA, $V_{CE} = 5.0$ V
		20		50			$I_C = 10$ μA, $V_{CE} = 5.0$ V, $T_A = -55°$ C
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Notes 4 & 5)	60		60		V	$I_C = 10$ mA (pulsed), $I_B = 0$

SYMBOL	CHARACTERISTIC	2484 MIN	2484 MAX	3117 MIN	3117 MAX	UNITS	TEST CONDITIONS
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.35		0.35	V	$I_C = 1.0$ mA, $I_B = 0.1$ mA
$V_{BE(ON)}$	Base to Emitter "On" Voltage	0.5	0.7		0.7	V	$I_C = 100$ μA, $V_{CE} = 5.0$ V
C_{ob}	Output Capacitance		6.0		4.5	pF	$V_{CB} = 5.0$ V, $I_E = 0$, f = 140 kHz
C_{ib}	Input Capacitance		6.0		6.0	pF	$V_{BE} = 0.5$ V, $I_C = 0$, f = 140 kHz
h_{fe}	High Frequency Current Gain	2.0		2.0			$I_C = 0.5$ mA, $V_{CE} = 5.0$ V, f = 30 MHz
		3.0					$I_C = 50$ μA, $V_{CE} = 5.0$ V, f = 5.0 MHz
		150	900	400	900		$I_C = 1.0$ mA, $V_{CE} = 5.0$ V, f = 1.0 kHz
h_{ie}	Input Resistance	3.5	24	10	24	kΩ	$I_C = 1.0$ mA, $V_{CE} = 5.0$ V, f = 1.0 kHz
h_{oe}	Output Conductance		40		40	μmhos	$I_C = 1.0$ mA, $V_{CE} = 5.0$ V, f = 1.0 kHz
h_{re}	Reverse Voltage Feedback Ratio		800		800	$x10^{-6}$	$I_C = 1.0$ mA, $V_{CE} = 5.0$ V, f ÷ 1.0 kHz
NF	Wide Band Noise Figure		3.0			dB	$I_C = 10$ μA, $V_{CE} = 5.0$ V, $R_S = 10$ kΩ, Power Bandwidth of 15.7 kHz with 3.0 dB pts at 10 Hz and 10 kHz

Electrical Characteristics (25° C Ambient Temperature unless otherwise noted)

Symbol	Characteristic	Min.	Max.	Units	Test Conditions
NF	Narrow Band Noise Figure	3.0		dB	$I_C = 10\ \mu A$, $V_{CE} = 5.0$ V, f = 1.0 kHz, $R_S = 10\ k\Omega$ Power Bandwidth of 200 Hz
		2.0		dB	$I_C = 10\ \mu A$, $V_{CE} = 5.0$ V, f = 10 kHz, $R_S = 10\ k\Omega$, Power Bandwidth of 2.0 kHz
		10		dB	$I_C = 10\ \mu A$, $V_{CE} = 5.0$ V, f = 100 Hz, $R_S = 10\ k\Omega$, Power Bandwidth of 20 Hz
			1.0	dB	$I_C = 5.0\ \mu A$, $V_{CE} = 5.0$ V, f = 1.0 kHz, $R_S = 50\ k\Omega$, Power Bandwidth of 200 Hz
			1.0	dB	$I_C = 5.0\ \mu A$, $V_{CE} = 5.0$ V, f = 10 kHz, $R_S = 50\ k\Omega$, Power Bandwidth of 1.0 kHz
			4.0	dB	$I_C = 30\ \mu A$, $V_{CE} = 5.0$ V, f = 100 kHz, $R_S = 10\ k\Omega$, Power Bandwidth of 20 Hz
			1.5	dB	$I_C = 30\ \mu A$, $V_{CE} = 5.0$ V, f = 10 Hz, $R_S = 10\ k\Omega$, Power Bandwidth of 2.0 Hz

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2N2710/FTSO2710

NPN Small Signal High Speed Low Power Saturating Switch Transistor

ABSOLUTE MAXIMUM RATINGS (Note 1)

PACKAGE

2N2710	TO-18
FTSO2710	TO-236AA/AB

Temperatures

Storage Temperature	-65° C to 200° C
Operating Junction Temperature	200° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	**2N**	**FTSO**
25° C Ambient Temperature	0.5 W	0.350 W*
25° C Case Temperature	1.2 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	20 V
V_{CES}	Collector to Emitter Voltage	30 V
V_{CBO}	Collector to Base Voltage	40 V
V_{EBO}	Emitter to Base Voltage	5.0 V
I_C	Collector Current	500 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage	20		V	$I_C = 10$ mA, $I_B = 0$
BV_{CES}	Collector to Emitter Breakdown Voltage	30		V	$I_C = 10\ \mu A$, $I_B = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	40		V	$I_C = 10\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0		V	$I_E = 10\ \mu A$, $I_C = 0$
I_{EBO}	Emitter Cutoff Current		1.0	μA	$V_{EB} = 3.0$ V, $I_C = 0$
I_{CBO}	Collector Cutoff Current (150° C)		30 30	nA μA	$V_{CB} = 20$ V, $I_E = 0$ $V_{CB} = 20$ V, $T_A = 150°$ C
h_{FE}	DC Current Gain (Note 5)	40 40			$I_C = 10$ mA, $V_{CE} = 1.0$ V $I_C = 50$ mA, $V_{CE} = 1.0$ V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage		0.25 0.40	V V	$I_C = 10$ mA, $I_B = 1.0$ mA $I_C = 50$ mA, $I_B = 5.0$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage		0.90 1.30	V V	$I_C = 10$ mA, $I_B = 1.0$ mA $I_C = 50$ mA, $I_B = 5.0$ mA

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 200° C and junction-to-case thermal resistance of 146° C/W (derating factor of 6.8 mW/° C); junction-to-ambient thermal resistance of 350° C/W (derating factor 2.8 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length ≤ 300 μs; duty cycle ≤ 2%, and ≤ 1.2 ms pulse duration.
6. For product family characteristic curves, refer to Curve Set T162.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
C_{ob}	Output Capacitance		4.0	pF	V_{CB} = 10 V, I_E = 0, f = 4.0 MHz
h_{fe}	High Frequency Current Gain	5.0			I_C = 10 mA, V_{CE} = 20 V, f = 100 MHz
τ_s	Charge Storage Time Constant (test circuit no. 3111)		15	ns	I_C = 10 mA, I_{B1} = I_{B2} = 10 mA
t_{on}	Turn On Time		20	ns	I_C = 10 mA, I_{B1} = 3.0 mA
t_{off}	Turn Off Time		35	ns	I_C = 10 mA, I_{B1} = 3.0 mA I_{B2} = 1.0 mA

3

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2N2904/5/6/7
PN2904/5/6/7
FTSO2904/5/6/7

PNP Small Signal General Purpose Amplifiers & Switches

- **V_{CEO} . . . −40 V (Min)**
- **h_{FE} . . . 40-120 (2N/PN/FTSO2904/6), 100-300 (2N/PN/FTSO2905/7)**
- **t_{on} . . . 45 ns (Max) @ 150 mA, t_{off} . . . 100 ns (Max) @ 150 mA**
- **Complements . . . 2N/PN/FTSO2218 Series, 2N/PN/FTSO2218A Series**

PACKAGE	
2N2904	TO-39
2N2905	TO-39
2N2906	TO-18
2N2907	TO-18
PN2904	TO-92
PN2905	TO-92
PN2906	TO-92
PN2907	TO-92
FTSO2904	TO-236AA/AB
FTSO2905	TO-236AA/AB
FTSO2906	TO-236AA/AB
FTSO2907	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures	**2N**	**PN/FTSO**
Storage Temperature	−65° C to 200° C	−55° C to 150° C
Operating Junction Temperature	175° C	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	**2N2904/5**	**2N2906/7**
25° C Ambient Temperature	0.6 W	0.4 W
25° C Case Temperature	3.0 W	1.8 W

Total Dissipation at	**PN**	**FTSO**
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents		**2N/PN2904**
V_{CEO}	Collector to Emitter Voltage (Note 4)	−40 V
V_{CBO}	Collector to Base Voltage	−60 V
V_{EBO}	Emitter to Base Voltage	−5.0 V
I_C	Collector Current	600 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	2N/PN2904/6 MIN	MAX		TEST CONDITIONS
h_{FE}	DC Current Gain (Note 5)	40	120		I_C = 150 mA, V_{CE} = −10 V
		20			I_C = 500 mA, V_{CE} = −10 V
		35			I_C = 10 mA, V_{CE} = −10 V
		25			I_C = 1.0 mA, V_{CE} = −10 V
		20			I_C = 0.1 mA, V_{CE} = −10 V

NOTES:
1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 200° C and junction-to-case thermal resistance of 58.3° C/W (derating factor of 17.2 mW/° C); junction-to-ambient thermal resistance of 292° C/W (derating factor of 3.42 mW/° C) for 2N2904 and 2N2905; junction-to-case thermal resistance of 97.3° C/W (derating factor of 10.3 mW/° C); junction-to-ambient thermal resistance of 437° C/W (derating factor of 2.28 mW/° C) for the 2N2906 and 2N2907. These ratings give a maximum junction resistance of 150° C and junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C) for PN2904, PN2905, PN2906, and PN2907; (TO236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T212.

* Package mounted on 99.5% alumina 8mm x 8mm x 0.6mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	2N/PN2905/7 MIN	MAX		TEST CONDITIONS
h_{FE}	DC Current Gain (Note 5)	100 30 75 50 35	300		$I_C = 150$ mA, $V_{CE} = -10$ V $I_C = 500$ mA, $V_{CE} = -10$ V $I_C = 10$ mA, $V_{CE} = -10$ V $I_C = 1.0$ mA, $V_{CE} = -10$ V $I_C = 0.1$ mA, $V_{CE} = -10$ V

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{EBO}	Emitter to Base Breakdown Voltage	−5.0		V	$I_C = 0$, $I_E = 10$ μA
BV_{CBO}	Collector to Base Breakdown Voltage	−60		V	$I_C = 10$ μA, $I_E = 0$
I_{CEX}	Collector Reverse Current		50	nA	$V_{CE} = -30$ V, $V_{EB} = -0.5$ V
I_{CBO}	Collector Cutoff Current		20 20	nA μA	$V_{CB} = -50$ V, $I_E = 0$ $V_{CB} = -50$ V, $I_E = 0$, $T_A = 150°$ C
I_B	Base Current		50	nA	$V_{CE} = -30$ V, $V_{EB} = -0.5$ V
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Notes 4 & 5)	−60		V	$I_C = 10$ mA (pulsed), $I_B = 0$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		−0.4 −1.6	V V	$I_C = 150$ mA, $I_B = 15$ mA $I_C = 500$ mA, $I_B = 50$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)		−1.3 −2.6	V V	$I_C = 150$ mA, $I_B = 15$ mA $I_C = 500$ mA, $I_B = 50$ mA
C_{ob}	Output Capacitance		8.0	pF	$V_{CB} = -10$ V, $I_E = 0$, f = 100 kHz
C_{ib}	Emitter Transition Capacitance		30	pF	$V_{EB} = -2.0$ V, $I_C = 0$, f = 100 kHz
h_{fe}	High Frequency Current Gain	2.0			$I_C = 50$ mA, $V_{CE} = -20$ V, f = 100 MHz
t_d	Turn On Delay Time (test circuit no. 224)		10	ns	$I_C = 150$ mA, $V_{CC} = -30$ V, $I_{B1} = 15$ mA
t_r	Rise Time (test circuit no. 224)		40	ns	$I_C = 150$ mA, $V_{CC} = -30$ V, $I_{B1} = I_{B2} = 15$ mA
t_s	Storage Time (test circuit no. 225)		80	ns	$I_C = 150$ mA, $V_{CC} = -6.0$ V, $I_{B1} = 15$ mA
t_f	Fall Time (test circuit no. 225)		30	ns	$I_C = 150$ mA, $V_{CC} = -6.0$ V, $I_{B1} = I_{B2} = 15$ mA

3

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2N2904A/5A/6A/7A
PN2904A/5A/6A/7A
FTSO2904A/5A/6A/7A
PNP Small Signal General Purpose Amplifiers & Switches

- **P_D ... 625 mW @ T_A = 25° C (PN Series)**
- **V_{CEO} ... -60 V (Min)**
- **h_{FE} ... 40-120 (2N/PN/FTSO2904A/6A), 100-300 (2N/PN/FTSO2905A/7A)**
- **t_{on} ... 45 ns (Max) @ 150 mA, t_{off} ... 100 ns (Max) @ 150 mA**
- **Complements ... 2N/PN/FTSO2218 Series, 2N/PN/FTSO2218A Series**

PACKAGE

2N2904A	TO-39
2N2905A	TO-39
2N2906A	TO-18
2N2907A	TO-18
PN2904A	TO-92
PN2905A	TO-92
PN2906A	TO-92
PN2907A	TO-92
FTSO2904A	TO-236AA/AB
FTSO2905A	TO-236AA/AB
FTSO2906A	TO-236AA/AB
FTSO2907A	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures	**2N**	**PN/FTSO**
Storage Temperature	-65° C to 200° C	-55° C to 150° C
Operating Junction Temperature	175° C	150° C

Power Dissipation (Notes 2 & 3)		
Total Dissipation at	**2N2904/5A**	**2N2906/7A**
25° C Ambient Temperature	0.6 W	0.4 W
25° C Case Temperature	3.0 W	1.8 W

Total Dissipation at	**PN**	**FTSO**
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents		**2N/PN**
V_{CEO}	Collector to Emitter Voltage (Note 4)	−40 V
V_{CBO}	Collector to Base Voltage	−60 V
V_{EBO}	Emitter to Base Voltage	−5.0 V
I_C	Collector Current	600 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	2904A/2906A MIN	MAX	UNITS	TEST CONDITIONS
h_{FE}	DC Current Gain (Note 5)	40	120		I_C = 150 mA, V_{CE} = −10 V
		40			I_C = 500 mA, V_{CE} = −10 V
		40			I_C = 10 mA, V_{CE} = −10 V
		40			I_C = 1.0 mA, V_{CE} = −10 V
		40			I_C = 0.1 mA, V_{CE} = −10 V

NOTES:
1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 200° C and junction-to-case thermal resistance of 58.3° C/W (derating factor of 17.2 mW/° C); junction-to-ambient thermal resistance of 292° C/W (derating factor of 3.42 mW/° C) for 2N2904A and 2N2905A; junction-to-case thermal resistance of 97.3° C/W (derating factor of 10.3 mW/° C); junction-to-ambient thermal resistance of 437° C/W (derating factor of 2.28 mW/° C) for the 2N2906A and 2N2907A. These ratings give a maximum junction resistance of 150° C and junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C) for PN2904A, PN2905A, PN2906A, and PN2907A; (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T212.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	2905A/2907A MIN	MAX	UNITS	TEST CONDITIONS
h_{FE}	DC Current Gain (Note 5)	100 50 100 100 75	300		$I_C = 150$ mA, $V_{CE} = -10$ V $I_C = 500$ mA, $V_{CE} = -10$ V $I_C = 10$ mA, $V_{CE} = -10$ V $I_C = 1.0$ mA, $V_{CE} = -10$ V $I_C = 0.1$ mA, $V_{CE} = -10$ V
BV_{EBO}	Emitter to Base Breakdown Voltage	−5.0		V	$I_C = 0$, $I_E = 10\ \mu A$
BV_{CBO}	Collector to Base Breakdown Voltage	−60		V	$I_C = 10\ \mu A$, $I_E = 0$
I_{CEX}	Collector Reverse Current		50	nA	$V_{CE} = -30$ V, $V_{EB} = -0.5$ V
I_{CBO}	Collector Cutoff Current		10 10	nA μA	$V_{CB} = -50$ V, $I_E = 0$ $V_{CB} = -50$ V, $I_E = 0$, $T_A = 150°$ C
I_B	Base Current		50	nA	$V_{CE} = -0$ V, $V_{EB} = -0.5$ V
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Notes 4 & 5)	−40		V	$I_C = 10$ mA (pulsed), $I_B = 0$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		−0.4 −1.6	V V	$I_C = 150$ mA, $I_B = 15$ mA $I_C = 500$ mA, $I_B = 50$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)		−1.3 −2.6	V V	$I_C = 150$ mA, $I_B = 15$ mA $I_C = 500$ mA, $I_B = 50$ mA
C_{ob}	Output Capacitance		8.0	pF	$V_{CB} = -10$ V, $I_E = 0$, f = 100 kHz
C_{ib}	Emitter Transition Capacitance		30	pF	$V_{EB} = -2.0$ V, $I_C = 0$, f = 100 kHz
h_{fe}	High Frequency Current Gain	2.0			$I_C = 50$ mA, $V_{CE} = -20$ V, f = 100 MHz
t_d	Turn On Delay Time (test circuit no. 224)		10	ns	$I_C = 150$ mA, $V_{CC} = -30$ V, $I_{B1} = 15$ mA
t_r	Rise Time (test circuit no. 224)		40	ns	$I_C = 150$ mA, $V_{CC} = -30$ V, $I_{B1} = I_{B2} = 15$ mA
t_s	Storage Time (test circuit no. 225)		80	ns	$I_C = 150$ mA, $V_{CC} = -6.0$ V, $I_{B1} = 15$ mA
t_f	Fall Time (test circuit no. 225)		30	ns	$I_C = 150$ mA, $V_{CC} = -6.0$ V, $I_{B1} = I_{B2} = 15$ mA
t_{on}	Turn On Time (test circuit no. 224)		45	ns	$I_C = 150$ mA, $V_{CC} = -3.0$ V, $I_{B1} = 15$ mA
t_{off}	Turn Off Time (test circuit no. 225)		100	ns	$I_C = 150$ mA, $V_{CC} = -6.0$ V, $I_{B1} = I_{B2} = 15$ mA

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2N3013/FTSO3013
2N3014/FTSO3014

NPN High Speed Saturated Logic Switches

- V_{CEO} ... **20 V (Min) (2N/FTSO3014), 15 V (Min) (2N/FTSO3013)**
- τ_s ... **18 ns (Max) @ 10 mA**
- t_{on} ... **15 ns (Max) @ 300 mA (2N/FTSO3013), 16 ns (Max) @ 30 mA (2N/FTSO3014)**
- t_{off} ... **25 ns (Max) @ 300 mA (2N/FTSO3013), @ 30 mA (2N/FTSO3014)**

PACKAGE

2N3013	TO-52
2N3014	TO-52
FTSO3013	TO-236AA/AB
FTSO3014	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures	**2N**	**FTSO**
Storage Temperature	-55° C to 200° C	-55° C to 150° C
Operating Junction Temperature	200° C	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	**2N**	**FTSO**
25° C Ambient Temperature	0.36 mW	0.350 W*
25° C Case Temperature	1.2 W	

Voltages & Currents		**3013**	**3014**
V_{CEO}	Collector to Emitter Voltage (Note 4)	15 V	20 V
V_{CBO}	Collector to Base Voltage	40 V	40 V
V_{CES}	Collector to Emitter Voltage	40 V	40 V
V_{EBO}	Emitter to Base Voltage	5.0 V	5.0 V
I_C	Collector Current	200 mA	200 mA
	(Pulse = 10 μs)	500 mA	500 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	3013 MIN	3013 MAX	3014 MIN	3014 MAX	UNITS	TEST CONDITIONS
BV_{CES}	Collector to Emitter Breakdown Voltage	40		40		V	$I_C = 100\ \mu A$, $V_{BE} = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	40		40		V	$I_C = 100\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0		5.0		V	$I_E = 100\ \mu A$, $I_C = 0$
I_{CES}	Collector Reverse Current (Note 5)		0.3 40		0.3 40	μA μA	$V_{CE} = 20$ V, $V_{BE} = 0$ $V_{CE} = 20$ V, $V_{BE} = 0$, $T_A = 125°$ C

NOTES:
1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 200° C and (TO-18) junction-to-case thermal resistance of 146° C/W (derating factor of 6.85 mW/° C); junction-to-ambient thermal resistance of 486° C/W (derating factor of 2.06 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T162.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	3013 MIN	3013 MAX	3014 MIN	3014 MAX	UNITS	TEST CONDITIONS
h_{FE}	DC Current Gain (Note 5)	30	120	30	120		$I_C = 30$ mA, $V_{CE} = 0.4$ V
				25			$I_C = 10$ mA, $V_{CE} = 0.4$ V
		25					$I_C = 100$ mA, $V_{CE} = 0.5$ V
				25			$I_C = 100$ mA, $V_{CE} = 1.0$ V
		15					$I_C = 300$ mA, $V_{CE} = 1.0$ V
		12		12			$I_C = 30$ mA, $V_{CE} = 0.4$ V, $T_A = -55°$ C
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Notes 4 & 5)	15		20		V	$I_C = 10$ mA, $I_B = 0$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)				0.18	V	$I_C = 10$ mA, $I_B = 1.0$ mA
			0.18		0.18	V	$I_C = 30$ mA, $I_B = 3.0$ mA
			0.28		0.35	V	$I_C = 100$ mA, $I_B = 10$ mA
			0.5			V	$I_C = 300$ mA, $I_B = 30$ mA
			0.25		0.25	V	$I_C = 30$ mA, $I_B = 3.0$ mA, $T_A = 125°$ C
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)	0.75	0.95	0.75	0.95	V	$I_C = 30$ mA, $I_B = 3.0$ mA
			1.2		1.2	V	$I_C = 100$ mA, $I_B = 10$ mA
			1.7			V	$I_C = 300$ mA, $I_B = 30$ mA
				0.7	0.8	V	$I_C = 10$ mA, $I_B = 1.0$ mA
C_{ob}	Output Capacitance		5.0		5.0	pF	$V_{CB} = 5.0$ V, $I_E = 0$
C_{ib}	Input Capacitance		8.0		8.0	pF	$V_{BE} = 0.5$ V, $I_C = 0$
h_{fe}	High Frequency Current Gain	3.5		3.5			$I_C = 30$ mA, $V_{CE} = 10$ V, f = 100 MHz
τ_s	Charge Storage Time Constant (test circuit no. 3111)		18		18	ns	$I_C \approx I_{B1} \approx = I_{B2} \approx 10$ mA
t_{on}	Turn On Time						
	(test circuit no 233)		15			ns	$I_C \approx 300$ mA, $I_{B1} \approx 30$ mA
	(test circuit no. 286)				16	ns	$I_C \approx 30$ mA, $I_{B1} \approx 3.0$ mA
t_{off}	Turn Off Time						
	(test circuit no. 233)		25			ns	$I_C \approx 300$ mA, $I_{B1} \approx -I_{B2} = 3.0$ mA
	(test circuit no. 286)				25	ns	$I_C \approx 30$ mA, $I_{B1} \approx -I_{B2} = 3.0$ mA

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2N3019/2N3020

NPN Small Signal General Purpose Amplifiers

- **V_{CEO} . . . 80 V (Min)**
- **$V_{CE(sat)}$ . . . 0.5 V (Max) @ 500 mA**
- **h_{FE} . . . 100-300 @ 150 mA (2N3019), 50 (Min) @ 100 μA & 500 mA (2N3019)**
- **Complements . . . 2N4031, 2N4033**

PACKAGE

2N3019	TO-5
2N3020	TO-5

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-65° to 200° C
Operating Junction Temperature	200° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	
25° C Ambient Temperature	0.8 W
25° C Case Temperature	5.0 W

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage	80 V
V_{CB}	Collector to Base Voltage	140 V
V_{EB}	Emitter to Base Voltage	7.0 V
I_C	Collector Current	1.0 A

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 5)

SYMBOL	CHARACTERISTIC	3019 MIN	3019 MAX	3020 MIN	3020 MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage (Note 4)	80		80		V	$I_C = 30$ mA, $I_B = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	140		140		V	$I_C = 100$ μA, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	7.0		7.0		V	$I_E = 100$ μA, $I_C = 0$
I_{EBO}	Emitter Cutoff Current		10		10	nA	$V_{EB} = 5.0$ V, $I_C = 0$
I_{CBO}	Collector Cutoff Current		10		10	nA	$V_{CB} = 90$ V, $I_E = 0$
			10		10	μA	$V_{CB} = 90$ V, $I_E = 0$, $T_A = 150°$ C
h_{FE}	DC Current Gain (Note 4)	50		30	100		$I_C = 0.1$ mA, $V_{CE} = 10$ V
		90		40	120		$I_C = 10$ mA, $V_{CE} = 10$ V
		100	300	40	120		$I_C = 150$ mA, $V_{CE} = 10$ V
		40					$I_C = 150$ mA, $V_{CE} = 10$ V, $T_A = -55°$ C
		50		30	100		$I_C = 500$ mA, $V_{CE} = 10$ V
		15		15			$I_C = 1.0$ A, $V_{CE} = 10$ V

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 200° C and junction-to-case thermal resistance of 35° C/W (derating factor of 28.6 mW/° C); junction-to-ambient thermal resistance of 217° C/W (derating factor of 4.6 mW/° C).
4. Pulse conditions: length ≤ 300 μs; duty cycle ≤ 1%.
5. For product family characteristic curves, refer to Curve Set T149.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 5)

SYMBOL	CHARACTERISTIC	3019 MIN	3019 MAX	3020 MIN	3020 MAX	UNITS	TEST CONDITIONS
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 4)		0.2 0.5		0.2 0.5	V V	I_C = 150 mA, I_B = 15 mA I_C = 500 mA, I_B = 50 mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 4)		1.1		1.1	V	I_C = 150 mA, I_B = 15 mA
C_{ob}	Output Capacitance		12		12	pF	V_{CB} = 10 V, I_E = 0, f = 1.0 MHz
C_{ib}	Input Capacitance		60		60	pF	V_{EB} = 0.5 V, I_C = 0, f = 1.0 MHz
h_{fe}	Small Signal Current Gain	80	400	30	200		I_C = 1.0 mA, V_{CE} = 5.0 V, f = 1.0 kHz
h_{fe}	Current Gain Bandwidth Product	5.0		5.0			I_C = 50 mA, V_{CE} = 10 V, f = 20 MHz
$r_b'C_c$	Collector Base Time Constant		400		400	ps	I_C = 10 mA, V_{CE} = 10 V, f = 4.0 MHz
NF	Noise Figure		4.0			dB	I_C = 100 μA, V_{CE} = 10 V, f = 1.0 kHz, R_S = 10 kΩ

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2N3053

NPN Small Signal General Purpose Amplifier

- V_{CEO} ... **40 V (Min)**
- h_{FE} ... **50-250 @ 150 mA**
- f_T ... **100 MHz (Min) @ 50 mA**

PACKAGE

2N3053	TO-39

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-65° C to 200° C
Operating Junction Temperature	175° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at 25° C Case Temperature	5.0 W
Linear Derating Factor	28.6 mW/° C

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage	40 V
V_{CBO}	Collector to Base Voltage	60 V
V_{EBO}	Emitter to Base Voltage	5.0 V
I_C	Collector Current (Continuous)	700 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 5)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{ECO}	Collector to Emitter Breakdown Voltage	40		V	$I_C = 100\ \mu A$, $I_E = 0$
BV_{CER}	Collector to Emitter Breakdown Voltage	50		V	$I_C = 100\ \mu A$, $R_{BE} = 10\Omega$
BV_{CBO}	Collector to Base Breakdown Voltage	60		V	$I_C = 100\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0		V	$I_C = 0$, $I_E = 100\ \mu A$
I_{CEX}	Collector Cutoff Current		0.25	μA	$V_{CE} = 30$ V, $V_{EB(OFF)} = 1.5$ V
I_{EBO}	Emitter to Base Cutoff Current		0.25	μA	$V_{EB} = 4.0$ V, $I_C = 0$
h_{FE}	DC Pulse Current Gain (Note 4)	25 50	 250		$I_C = 150$ mA, $V_{CE} = 2.5$ V $I_C = 150$ mA, $V_{CE} = 10$ V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 4)		1.4	V	$I_C = 150$ mA, $I_B = 1.5$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 4)		1.7	V	$I_C = 150$ mA, $I_B = 15$ mA
$V_{BE(ON)}$	Base to Emitter "On" Voltage		1.7	V	$I_C = 150$ mA, $V_{CE} = 2.5$ V
C_{ob}	Output Capacitance		15	pF	$V_{CB} = 10$ V, $I_E = 0$, f = 140 kHz
C_{ib}	Input Capacitance		80	pF	$V_{EB} = 0.5$ V, $I_C = 0$, f = 140 kHz
h_{fe}	Current Gain Bandwidth Product	5.0			$I_C = 50$ mA, $V_{CE} = 10$ V, f = 20 MHz

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 200° C and junction-to-case thermal resistance of 35° C/W (derating factor of 28.6 mW/° C).
4. Pulse conditions: length = 300 μs; duty cycle = 2%.
5. For product family characteristic curves, refer to Curve Set T149.

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2N3107/2N3108
2N3109

NPN Small Signal General Purpose Amplifiers & Saturated Switches

- V_{CEO} ... 40 V (Min) (2N3109), 60 V (Min) (2N3107/8)
- $V_{CE(sat)}$ ... 1.0 V (Max) @ 1.0 A
- h_{FE} ... 100-300 @ 150 mA (2N3107/9), 40 (Min) @ 500 mA (2N3107/9, 40 (Min) @ 500 mA (2N3107/9)
- t_{on} ... 200 ns (Max) @ 150 mA
- t_{off} ... 600 ns (Max) (2N3108), 1.0 μs (Max) (2N3107/9) @ 150 mA
- NF ... 7.0 dB (Max) @ 1.0 kHz

PACKAGE

2N3107	TO-39
2N3108	TO-39
2N3109	TO-39

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-65° C to 200° C
Operating Junction Temperature	200° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	
25° C Ambient Temperature	0.8 W
25° C Case Temperature	5.0 W

Voltages & Currents		**3107/8**	**3109**
V_{CEO}	Collector to Emitter Voltage (Note 4)	60 V	40 V
V_{CBO}	Collector to Base Voltage	100 V	80 V
V_{EBO}	Emitter to Base Voltage	7.0 V	7.0 V

3

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 7)

SYMBOL	CHARACTERISTIC	3107/9 MIN	3107/9 MAX	3108 MIN	3108 MAX	UNITS	TEST CONDITIONS
BV_{CBO}	Collector to Base Breakdown Voltage (2N3107 only)	100				V	$I_C = 100\ \mu A$, $I_E = 0$
	(2N3108 only)			100		V	$I_C = 100\ \mu A$, $I_E = 0$
	(2N3109 only)	80				V	$I_C = 100\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	7.0		7.0		V	$I_E = 100\ \mu A$, $I_C = 0$
I_{EBO}	Emitter Cutoff Current		10		10	nA	$V_{EB} = 5.0$ V, $I_C = 0$
I_{CBO}	Collector Cutoff Current		10		10	μA	$V_{CB} = 60$ V, $I_E = 0$, $T_A = 150°$ C
I_{CES}	Collector Reverse Current		10		10	nA	$V_{CE} = 60$ V, $V_{EB} = 0$

NOTES:
1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 200° C and junction-to-case thermal resistance of 35° C/W (derating factor of 28.6 mW/° C); junction-to-ambient thermal resistance of 218° C/W (derating factor of 4.5 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. Saturation voltage measured with 1/4" lead length.
7. For product family characteristic curves, refer to Curve Set T149.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	3107/9 MIN	3107/9 MAX	3108 MIN	3108 MAX	UNITS	TEST CONDITIONS
h_{FE}	DC Pulse Current Gain (Note 5)	100 40 35 30	300	40 25 20 15	120		$I_C = 150$ mA, $V_{CE} = 1.0$ V $I_C = 500$ mA, $V_{CE} = 10$ V $I_C = 0.1$ mA, $V_{CE} = 10$ V $I_C = 150$ mA, $V_{CE} = 10$ V, $T_A = -55°$ C
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Notes 4 & 5) (2N3107) (2N3108) (2N3109)	60 40		 60 		V V V	$I_C = 30$ mA, $I_B = 0$ $I_C = 30$ mA, $I_B = 0$ $I_C = 30$ mA, $I_B = 0$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5) (Notes 5 & 6)		0.25 1.0		0.25 1.0	V V	$I_C = 150$ mA, $I_B = 15$ mA $I_C = 1.0$ A, $I_B = 100$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5) (Notes 5 & 6)		1.1 2.0		1.1 2.0	V V	$I_C = 150$ mA, $I_B = 15$ mA $I_C = 1.0$ A, $I_B = 100$ mA
C_{ob}	Open Circuit Output Capacitance (2N3107) (2N3108) (2N3109)		20 25		 20 	pF pF pF	$V_{CB} = 10$ V, $I_E = 0$, f = 140 kHz $V_{CB} = 10$ V, $I_E = 0$, f = 140 kHz $V_{CB} = 10$ V, $I_E = 0$, f = 140 kHz
C_{ib}	Open Circuit Input Capacitance		80		80	pF	$V_{EB} = 0.5$ V, $I_E = 0$, f = 140 kHz
t_{on}	Turn On Time (test circuit no. 288)		200		200	ns	$I_C \approx 150$ mA, $I_{B1} \approx 7.5$ mA, $I_{B2} \approx 7.5$ mA
t_{off}	Turn Off Time (test circuit no. 289)		1000		600	ns	$I_C \approx 150$ mA, $I_{B1} \approx 7.5$ mA, $I_{B2} \approx 7.5$ mA

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2N3251/PN3251 FTSO3251

PNP Small Signal General Purpose Amplifiers & Switches

- **V_{CEO} ... −40 V (Min) (2N/PN/FTSO3251)**
- **h_{FE} ... 100-300 @ 10 mA**
- **NF ... 6.0 dB @ I_C = 100 μA, V_{CE} = −5.0 V**
- **Complements ... 2N3946 (40 V); 2N870, 2N871 (60 V) — (TO-18); 2N3903, 2N3904 (40 V)**

PACKAGE

2N3251	TO-18
PN3251	TO-92
FTSO3251	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures	**PN/FTSO**	**2N**
Storage Temperature	−55° C to 150° C	−65° C to 200° C
Operating Junction Temperature	150° C	175° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	**PN**	**2N**	**FTSO**
25° C Ambient Temperature	0.625 W	0.36 W	0.350 W*
25° C Case Temperature	1.0 W	1.2 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	−40 V
V_{CBO}	Collector to Base Voltage	−50 V
V_{EBO}	Emitter to Base Voltage	−5.0 V
I_C	Collector Current	200 mA

3

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage (Notes 4 & 5)	−40		V	I_C = 10 mA, I_B = 0
BV_{CBO}	Collector to Base Breakdown Voltage	−50		V	I_C = 10 μA, I_E = 0
BV_{EBO}	Emitter to Base Breakdown Voltage	−5.0		V	I_E = 10 μA, I_C = 0
I_{CEX}	Collector Reverse Current (Note 5)		20	nA	V_{CE} = −40 V, V_{EB} = −3.0 V
I_{BL}	Base Current		50	nA	V_{CE} = −40 V, V_{EB} = −3.0 V
h_{FE}	DC Current Gain	80 90			I_C = 100 μA, V_{CE} = −1.0 V I_C = 1.0 μA, V_{CE} = −1.0 V

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 200° C and (TO-18) junction-to-case thermal resistance of 145° C/W (derating factor of 6.9 mW/° C); junction-to-ambient thermal resistance of 486° C/W (derating factor of 2.1 mW/° C) for 2N series. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T215.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
h_{FE}	DC Pulse Current Gain (Note 5)	100 30	300		I_C = 10 mA, V_{CE} = −1.0 V I_C = 50 mA, V_{CE} = −1.0 V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		−0.25 −0.50	V V	I_C = 10 mA, I_B = 1.0 mA I_C = 50 mA, I_B = 5.0 mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)	−0.6	−0.9 −1.2	V V	I_C = 10 mA, I_B = 1.0 mA I_C = 50 mA, I_B = 5.0 mA
C_{ob}	Output Admittance		6.0	pF	V_{CB} = 10 V, I_E = 0, f = 100 kHz
C_{ib}	Input Capacitance		8.0	pF	V_{EB} = 1.0 V, I_C = 0, f = 100 kHz
h_{fe}	High Frequency Current Gain	3.0			I_C = 10 mA, V_{CE} = −20 V, f = 100 MHz
h_{fe}	Small Signal Current Gain	100	400		I_C = 1.0 mA, V_{CE} = 10 V, f = 1.0 kHz
h_{ie}	Input Impedance	2.0	12	kΩ	I_C = 1.0 mA, V_{CE} = 10 V, f = 1.0 kHz
h_{oe}	Output Admittance	10	60	μmhos	I_C = 1.0 mA, V_{CE} = 10 V, f = 1.0 kHz
h_{re}	Voltage Feedback Ratio		20	$\times 10^{-4}$	I_C = 1.0 mA, V_{CE} = 10 V, f = 1.0 kHz
t_d	Turn On Delay Time (test circuit no. 333)		35	ns	I_C = 10 mA, V_{CC} = 3.0 V, I_{B1} = 1.0 mA
t_r	Rise Time (test circuit no. 333)		35	ns	I_C = 10 mA, V_{CC} = 3.0 V, I_{B1} = 1.0 mA
t_s	Storage Time (test circuit no. 239)		200	ns	I_C = 10 mA, V_{CC} = 3.0 V, I_{B1} = I_{B2} = 1.0 mA
t_f	Fall Time (test circuit no. 239)		50	ns	I_C = 10 mA, V_{CC} = 3.0 V, I_{B1} = I_{B2} = 1.0 mA
$r_b'C_c$	Collector Base Time Constant		250	ps	I_C = 10 mA, V_{CE} = −20 V, f = 31.8 MHz
NF	Noise Figure		6.0	dB	I_C = 100 μA, V_{CE} = −5.0 V, f = 100 Hz, R_G = 1.0 kΩ

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2N3253

NPN Switching Type

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	−65° C to 200° C
Operating Junction Temperature	200° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	
25° C Ambient Temperature	0.8 W
25° C Case Temperature	3.0 W

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	40 V
V_{CBO}	Collector to Base Voltage	75 V
V_{EBO}	Emitter to Base Voltage	5.0 V
I_C	Collector Current	1.0 A

PACKAGE

2N3253	TO-39

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CBO}	Collector to Base Breakdown Voltage	75		V	$I_C = 10\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0		V	$I_E = 10\ \mu A$, $I_C = 0$
I_{EBO}	Emitter Cutoff Current		50	nA	$V_{EB} = 4.0$ V, $I_C = 0$
I_{CBO}	Collector Reverse Current		500	nA	$V_{CB} = 60$ V, $I_E = 0$
	(100° C)		75	μA	$V_{CB} = 60$ V, $I_E = 0$
I_{CEX}	Collector Reverse Current		500	nA	$V_{CE} = 60$ V, $V_{EB} = 4.0$ V
I_{BL}	Base Current		500	nA	$V_{CE} = 60$ V, $V_{OB} = 4.0$ V
h_{FE}	DC Pulse Current Gain (Note 5)	25			$I_C = 150$ mA, $V_{CE} = 1.0$ V
		25	75		$I_C = 375$ mA, $V_{CE} = 1.0$ V
		20			$I_C = 750$ mA, $V_{CE} = 5.0$ V
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Notes 4 & 5)	40		V	$I_C = 10$ mA, $I_B = 0$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Pulsed) (Note 5)		0.35	V	$I_C = 150$ mA, $I_B = 15$ mA
			0.6	V	$I_C = 500$ mA, $I_B = 50$ mA
			1.2	V	$I_C = 1.0$ A, $I_B = 100$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Pulsed) (Note 5)		1.0	V	$I_C = 150$ mA, $I_B = 15$ mA
		0.7	1.3	V	$I_C = 500$ mA, $I_B = 50$ mA
			1.8	V	$I_C = 1.0$ A, $I_B = 100$ mA

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle ⩽ 1%.
6. For product family characteristic curves, refer to Curve Set T139.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
C_{ob}	Output Capacitance		12	pF	$V_{CB} = 20$ V, $I_E = 0$
C_{ib}	Input Capacitance		80	pF	$V_{EB} = 0.5$ V, $I_C = 0$
h_{fe}	High Frequency Current Gain	1.75			$I_C = 50$ mA, $V_{CE} = 10$ V, f = 100 MHz
t_d	Turn On Delay Time (test circuit no. 3164)		15	ns	$I_C = 500$ mA, $I_{B1} = 50$ mA
t_r	Rise Time (test circuit no. 3164)		35	ns	$I_C = 500$ mA, $I_{B1} = 50$ mA
t_s	Storage Time (test circuit no. 3165)		40	ns	$I_C = 500$ mA, $I_{B1} = I_{B2} = 50$ mA
t_f	Fall Time (test circuit no. 3165)		30	ns	$I_C = 500$ mA, $I_{B1} = I_{B2} = 50$ mA
Q_T	Total Control Charge (test circuit no. 3163)		5.0	ncoul	$I_C = 500$ mA, $I_B = 50$ mA

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2N3439/2N3440

NPN Power

- P_D ... 10 W @ T_C = 25° C
- V_{CEO} ... 250-350 V (Min)

PACKAGE

2N3439	TO-39
2N3440	TO-39

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-65° C to 200° C
Operating Junction Temperature	-65° C to 200° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	
25° C Ambient Temperature	1.0 W
25° C Case Temperature	10 W

Voltages & Currents		**3439**	**3440**
V_{CEO}	Collector to Emitter Voltage (Applicable from 0 to 50 mA)	350 V	250 V
V_{CBO}	Collector to Base Voltage	450 V	300 V
V_{EBO}	Emitter to Base Voltage	7.0 V	7.0 V
I_C	Collector Current (Continuous)	1.0 A	1.0 A
I_B	Base Current (Continuous)	0.5 A	0.5 A

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
I_{EBO}	Emitter Cutoff Current		20	μA	V_{EB} = 6.0 V, I_C = 0
I_{CBO}	Collector Cutoff Current (2N3439)		20	μA	V_{CB} = 360 V, I_E = 0
	(2N3440)		20	μA	V_{CB} = 250 V, I_E = 0
h_{FE}	DC Pulse Current Gain (Note 2)	40	160		I_C = 20 mA, V_{CE} = 10 V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 2)		0.5	V	I_C = 50 mA, I_B = 4.0 mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 2)		1.3	V	I_C = 50 mA, I_B = 4.0 V
C_{ob}	Output Capacitance		10	pF	V_{CB} = 10 V, I_E = 0, f = 1.0 MHz
C_{ib}	Input Capacitance		75	pF	V_{EB} = 5.0 V, I_C = 0, f = 1.0 MHz
$\|h_{fe}\|$	Magnitude of Common Emitter Small Signal Current Gain	3.0			I_C = 10 mA, V_{CE} = 10 V, f = 5.0 MHz
h_{fe}	Small Signal Current Gain	25			I_C = 5.0 mA, V_{CE} = 10 V, f = 1.0 kHz

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction operating temperature of 200° C and junction-to-case thermal resistance of 17.5° 1C/W (derating factor of 5.0 mW/° C); junction-to-ambient thermal resistance of 175° C/W (derating factor of 5.7 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T333.

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2N3700/2N3701

NPN Small Signal General Purpose Amplifiers

- V_{CEO} ... **80 V (Min) @ 30 mA**
- $V_{CE(sat)}$ ... **0.5 V (Max) @ 500 mA**

PACKAGE

2N3700	TO-18
2N3701	TO-18

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-65° C to 200° C
Operating Junction Temperature	200° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	
25° C Ambient Temperature	0.5 W
100° C Case Temperature	1.0 W
25° C Case Temperature	1.8 W

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	80 V
V_{CBO}	Collector to Base Voltage	140 V
V_{EBO}	Emitter to Base Voltage	7.0 V
I_C	Collector Current	1.0 A

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	3700 MIN	3700 MAX	3701 MIN	3701 MAX	UNITS	TEST CONDITIONS
BV_{CBO}	Collector to Base Breakdown Voltage	140		140		V	$I_C = 100\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	7.0		7.0		V	$I_E = 100\ \mu A$, $I_C = 0$
I_{EBO}	Emitter Cutoff Current		10		10	nA	$V_{EB} = 5.0$ V, $I_C = 0$
I_{CBO}	Collector Cutoff Current		10		10	nA	$V_{CB} = 90$ V, $I_E = 0$
			10		10	μA	$V_{CB} = 90$ V, $I_E = 0$, $T_A = 150°$ C
h_{FE}	DC Pulse Current Gain (Note 5)	100	300	40	120		$I_C = 150$ mA, $V_{CE} = 10$ V
		90		40	120		$I_C = 10$ mA, $V_{CE} = 10$ V
		50		30	100		$I_C = 0.1$ mA, $V_{CE} = 10$ V
		50		30	100		$I_C = 500$ mA, $V_{CE} = 10$ V
		15		15			$I_C = 1.0$ mA, $V_{CE} = 10$ V
		40					$I_C = 150$ mA, $V_{CE} = 10$ V, $T_A = -55°$ C

NOTES:
1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 200° C and junction-to-case thermal resistance of 97° C/W (derating factor of 10.3 mW/° C); junction-to-ambient thermal resistance of 350° C/W (derating factor of 2.85 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle $\leqslant$ 1%.
6. For product family characteristic curves, refer to Curve Set T149.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	3700 MIN	3700 MAX	3701 MIN	3701 MAX	UNITS	TEST CONDITIONS
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Notes 4 & 5)	80		80		V	$I_C = 30$ mA, $I_B = 0$
$V_{CE(sat)}$	Pulsed Collector to Emitter Saturation Voltage (Note 5)		0.2 0.5		0.2 0.5	V V	$I_C = 150$ mA, $I_B = 15$ mA $I_C = 500$ mA, $I_B = 50$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Pulsed)		1.1		1.1	V	$I_C = 150$ mA, $I_B = 15$ mA
C_{ob}	Output Capacitance		12		12	pF	$V_{CB} = 10$ V, $I_E = 0$, f = 1.0 MHz
C_{ib}	Input Capacitance		60		60	pF	$V_{EB} = 0.5$ V, $I_C = 0$, f = 1.0 MHz
h_{fe}	High Frequency Current Gain	5.0	10	4.0	10		$I_C = 50$ mA, $V_{CE} = 10$ V, f = 20 MHz
h_{fe}	Small Signal Current Gain	80	400	30	200		$I_C = 1.0$ mA, $V_{CE} = 5.0$ V, f = 1.0 kHz
$r_b'C_c$	Collector to Base Time Constant	25	400	25	400	ps	$I_C = 10$ mA, $V_{CB} = 10$ V, f = 4.0 MHz
NF	Noise Figure		4.0			dB	$I_C = 100$ μA, $V_{CE} = 10$ V, f = 1.0 kHz, $R_G = 1.0$ kΩ

3

FAIRCHILD

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2N3724/2N3725
2N4013/2N4014

NPN Small Signal High Current High Speed Switches

- V_{CEO} ... 30 V (Min) (2N3724, 2N4013), 50 V (Min) (2N3725, 2N4014)
- $V_{CE(sat)}$ ... 0.65 V (Max) @ 800 mA, 0.75 V (Max) @ 1.0 A (2N3724, 2N4013)
- h_{FE} ... 60-150 @ 1.0 A (2N3724, 2N4013)
- t_{on} ... 35 ns (Max), t_{off} ... 60 ns (Max) @ 500 mA

PACKAGE

2N3724	TO-5
2N3725	TO-5
2N4013	TO-18
2N4014	TO-18

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-65° C to 200° C
Operating Junction Temperature	200° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	4013/4	3724/5
25° C Ambient Temperature	0.36 W	0.8 W
25° C Case Temperature	1.2 W	3.5 W

Voltages & Currents		3724/4013	3725/4014
V_{CEO}	Collector to Emitter Voltage (Note 4)	30 V	50 V
V_{CBO}	Collector to Base Voltage	50 V	80 V
V_{CES}	Collector to Emitter Voltage	50 V	80 V
V_{EBO}	Emitter to Base Voltage	6.0 V	6.0 V
I_C	Collector Current (Note 5)	1.0 A	1.0 A
I_C	DC Collector Current	500 mA	500 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	3724/4013 MIN	3724/4013 MAX	3725/4014 MIN	3725/4014 MAX	UNITS	TEST CONDITIONS
BV_{CES}	Collector to Emitter Breakdown Voltage	50		80		V	$I_C = 10\ \mu A$, $V_{BE} = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	50		50		V	$I_C = 10\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	6.0		6.0		V	$I_E = 10\ \mu A$, $I_C = 0$

NOTES:
1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 200° C and junction-to-case thermal resistance of 50 ° C/W (derating factor of 20 mW/° C) for 2N3724 and 2N3725; and 146° C/W (derating factor of 6.85 mW/° C) for the 2N4013 and 2N4014; junction-to-ambient thermal resistance of 219° C/W (derating factor of 4.56 mW/° C) for the 2N3724, 2N3725, and 485° C/W (derating factor of 2.06 mW/° C) for the 2N4013 and 2N4014.
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T162 for 2N3724/5 and T139 for 2N4013/4

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	3724/4013 MIN	3724/4013 MAX	3725/4014 MIN	3725/4014 MAX	UNITS	TEST CONDITIONS
I_{CBO}	Collector Cutoff Current		1.7			μA	$V_{CB} = 40$ V, $I_E = 0$
					1.7	μA	$V_{CB} = 60$ V, $I_E = 0$
			120			μA	$V_{CB} = 40$ V, $I_E = 0$, $T_A = 100°$ C
					120	μA	$V_{CB} = 60$ V, $I_E = 0$, $T_A = 100°$ C
I_{CES}	Collector Reverse Current		10			μA	$V_{CE} = 50$ V, $I_E = 0$
					10	μA	$V_{CE} = 80$ V, $I_E = 0$
h_{FE}	DC Pulse Current Gain (Note 5)	60	150	60	150		$I_C = 100$ mA, $V_{CE} = 1.0$ V
		35		35			$I_C = 500$ mA, $V_{CE} = 1.0$ V
		40		40			$I_C = 300$ mA, $V_{CE} = 1.0$ V
		30		25			$I_C = 1.0$ A, $V_{CE} = 5.0$ V
		30		30			$I_C = 10$ mA, $V_{CE} = 1.0$ V
		25		20			$I_C = 800$ mA, $V_{CE} = 2.0$ V
		30		30			$I_C = 100$ mA, $V_{CE} = 1.0$ V, $T_A = -55°$ C
		20		20			$I_C = 500$ mA, $V_{CE} = 1.0$ V, $T_A = -55°$ C
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Notes 4 & 5)	30		50		V	$I_C = 10$ mA, $I_B = 0$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.25		0.25	V	$I_C = 10$ mA, $I_B = 1.0$ mA
			0.2		0.26	V	$I_C = 100$ mA, $I_B = 10$ mA1
			0.32		0.4	V	$I_C = 300$ mA, $I_B = 30$ mA
			0.42		0.52	V	$I_C = 500$ mA, $I_B = 50$ mA
			0.65		0.8	V	$I_C = 800$ mA, $I_B = 80$ mA
			0.75		0.95	V	$I_C = 1.0$ A, $I_B = 100$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)		0.76		0.76	V	$I_C = 10$ mA, $I_B = 1.0$ mA
			0.86		0.86	V	$I_C = 100$ mA, $I_B = 10$ mA
			1.1		1.1	V	$I_C = 300$ mA, $I_B = 30$ mA
			1.5		1.5	V	$I_C = 800$ mA, $I_B = 80$ mA
			1.7		1.7	V	$I_C = 1.0$ A, $I_B = 100$ mA
		0.8	1.1	0.8	1.1	V	$I_C = 500$ mA, $I_B = 50$ mA
C_{ob}	Output Capacitance		12		10	pF	$V_{CB} = 10$ V, $I_E = 0$
C_{ib}	Input Capacitance		55		55	pF	$V_{BE} = 0.5$ V, $I_C = 0$
h_{fe}	High Frequency Current Gain	3.0		3.0			$I_C = 50$ mA, $V_{CE} = 10$ V, f = 100 MHz
t_{on}	Turn On Time (test circuit no. 265)		35		35	ns	$I_C = 500$ mA, $I_{B1} = 50$ mA
t_{off}	Turn Off Time (test circuit no. 265)		60		60	ns	$I_C = 500$ mA, $I_{B1} = 50$ mA, $I_{B2} = -50$ mA

FAIRCHILD

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2N3903/FTSO3903
2N3904/FTSO3904

NPN Small Signal General Purpose Amplifiers & Switches

- **V_{CEO} ... 40 V (Min)**
- **h_{FE} ... 100-300 @ 10 mA (2N/FTSO3904)**
- **NF ... 5.0 dB (Max) Wide Band (2N/FTSO3904)**
- **Complements ... 2N3905, 2N3906**

PACKAGE

2N3903	TO-92
2N3904	TO-92
FTSO3903	TO-236AA/AB
FTSO3904	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	−55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	2N	FTSO
25° C Ambient Temperature	0.625 W	0.350 W*
70° C Ambient Temperature	0.400 W	
25° C Case Temperature	1.0 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	40 V
V_{CBO}	Collector to Base Voltage	60 V
V_{EBO}	Emitter to Base Voltage	6.0 V
I_C	Collector Current	200 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 5)

SYMBOL	CHARACTERISTIC	3903 MIN	3903 MAX	3904 MIN	3904 MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage (Note 4)	40		40		V	$I_C = 1.0$ mA, $I_B = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	60		60		V	$I_C = 10\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	6.0		6.0		V	$I_E = 10\ \mu A$, $I_C = 0$
I_{CEX}	Collector Cutoff Current		50		50	nA	$V_{CE} = 30$ V, $V_{EB} = 3.0$ V
I_{BL}	Base Cutoff Current		50		50	nA	$V_{CE} = 30$ V, $V_{EB} = 3.0$ V
h_{FE}	DC Current Gain (Note 4)	20		40			$I_C = 0.1$ mA, $V_{CE} = 1.0$ V
		35		70			$I_C = 1.0$ mA, $V_{CE} = 1.0$ V
		50	150	100	300		$I_C = 10$ mA, $V_{CE} = 1.0$ V
		30		60			$I_C = 50$ mA, $V_{CE} = 1.0$ V
		15		30			$I_C = 100$ mA, $V_{CE} = 1.0$ V

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Pulse conditions: length = 300 μs; duty cycle = 2%.
5. For product family characteristic curves, refer to Curve Set T144.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 5)

SYMBOL	CHARACTERISTIC	3903 MIN	3903 MAX	3904 MIN	3904 MAX	UNITS	TEST CONDITIONS
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 4)		0.2 0.3		0.2 0.3	V V	I_C = 10 mA, I_B = 1.0 mA I_C = 50 mA, I_B = 5.0 mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 4)	0.65	0.85 0.95	0.65	0.85 0.95	V V	I_C = 10 mA, I_B = 1.0 mA I_C = 50 mA, I_B = 5.0 mA
C_{ob}	Output Capacitance		4.0		4.0	pF	V_{CB} = 5.0 V, I_E = 0, f = 100 kHz
C_{ib}	Input Capacitance		8.0		8.0	pF	V_{BE} = 0.5 V, I_C = 0, f = 100 kHz
h_{fe}	Small Signal Current Gain	50	200	100	400		I_C = 1.0 mA, V_{CE} = 10 V, f = 1.0 kHz
h_{ie}	Input Impedance	1.0	8.0	1.0	10	kΩ	I_C = 1.0 mA, V_{CE} = 10 V, f = 1.0 kHz
h_{oe}	Output Admittance	1.0	40	1.0	40	μmho	I_C = 1.0 mA, V_{CE} = 10 V, f = 1.0 kHz
h_{re}	Voltage Feedback Ratio	0.1	5.0	0.5	8.0	$x10^{-4}$	I_C = 1.0 mA, V_{CE} = 10 V, f = 1.0 kHz
f_T	Current Gain Bandwidth Product	250		300		MHz	I_C = 10 mA, V_{CE} = 20 V, f = 100 MHz
t_d	Turn On Delay Time (test circuit no. 526)		35		35	ns	I_C = 10 mA, V_{CC} = 3.0 V, I_{B1} = 10 mA, $V_{BE(OFF)}$ = 0.5 V
t_r	Rise Time (test circuit no. 526)		35		35	ns	I_C = 10 mA, V_{CC} = 3.0 V, I_{B1} = 10 mA, $V_{BE(OFF)}$ = 0.5 V
t_s	Storage Time (test circuit no. 527)		175		200	ns	I_C = 10 mA, V_{CC} = 3.0 V, I_{B1} = I_{B2} = 1.0 mA
t_f	Fall Time (test circuit no. 527)		50		50	ns	I_C = 10 mA, V_{CC} = 3.0 V, I_{B1} = I_{B2} = 1.0 mA
NF	Noise Figure		6.0		5.0	dB	I_C = 100 μA, V_{CE} = 5.0 V, f = 10 Hz to 15.7 kHz, R_G = 1.0 kΩ

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2N3905/FTSO3905
2N3906/FTSO3906

PNP Small Signal General Purpose Amplifiers & Switches

- V_{CEO} ... **-40 V (Min)**
- **h_{FE} ... 100-300 @ 10 mA (2N3906)**
- **NF ... 4.0 dB (Max) Wide Band (2N3906)**
- **Complements ... 2N3903, 2N3904**

PACKAGE

2N3905	TO-92
2N3906	TO-92
FTSO3905	TO-236AA/AB
FTSO3906	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	2N	FTSO
25° C Ambient Temperature	0.625 W	0.350 W*
70° C Ambient Temperature	0.400 W	
25° C Case Temperature	1.0 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	−40 V
V_{CBO}	Collector to Base Voltage	−40 V
V_{EBO}	Emitter to Base Voltage	−5.0 V
I_C	Collector Current	200 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	3905 MIN	3905 MAX	3906 MIN	3906 MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage (Note 5)	−40		−40		V	$I_C = 1.0$ mA, $I_B = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	−40		−40		V	$I_C = 10\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	−5.0		−5.0		V	$I_E = 10\ \mu A$, $I_C = 0$
I_{CEX}	Collector Cutoff Current		50		50	nA	$V_{CE} = -30$ V, $V_{EB} = -3.0$ V
I_{BL}	Base Cutoff Current		50		50	nA	$V_{CE} = -30$ V, $V_{EB} = -3.0$ V
h_{FE}	DC Pulse Current Gain (Note 5)	30		60			$I_C = 0.1$ mA, $V_{CE} = -1.0$ V
		40		80			$I_C = 1.0$ mA, $V_{CE} = -1.0$ V
		50	150	100	300		$I_C = 10$ mA, $V_{CE} = -1.0$ V
		30		60			$I_C = 50$ mA, $V_{CE} = -1.0$ V
		15		30			$I_C = 100$ mA, $V_{CE} = -1.0$ V

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle ≤ 2%.
6. For product family characteristic curves, refer to Curve Set T215.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	3905 MIN	3905 MAX	3906 MIN	3906 MAX	UNITS	TEST CONDITIONS
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		−0.25 −0.4		−0.25 −0.4	V V	$I_C = 10$ mA, $I_B = 1.0$ mA $I_C = 50$ mA, $I_B = 5.0$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)	−0.65	−0.85 −0.95	−0.65	−0.85 −0.95	V V	$I_C = 10$ mA, $I_B = 1.0$ mA $I_C = 50$ mA, $I_B = 5.0$ mA
C_{ob}	Output Capacitance		4.5		4.5	pF	$V_{CB} = -5.0$ V, $I_E = 0$, f = 100 kHz
C_{ib}	Input Capacitance		10		10	pF	$V_{EB} = -0.5$ V, $I_C = 0$, f = 100 kHz
h_{fe}	Small Signal Current Gain	50	200	100	400		$I_C = 1.0$ mA, $V_{CE} = -10$ V, f = 1.0 kHz
h_{ie}	Input Impedance	0.5	8.0	2.0	10	kΩ	$I_C = 1.0$ mA, $V_{CE} = -10$ V, f = 1.0 kHz
h_{oe}	Output Admittance	1.0	40	3.0	60	μmho	$I_C = 1.0$ mA, $V_{CE} = -10$ V, f = 1.0 kHz
h_{re}	Voltage Feedback Ratio	0.1	5.0	0.1	10	$\times 10^{-4}$	$I_C = 1.0$ mA, $V_{CE} = -10$ V, f = 1.0 kHz
f_T	Current Gain Bandwidth Product	200		250		MHz	$I_C = 10$ mA, $V_{CE} = -20$ V, f = 100 MHz
t_d	Turn On Delay Time (test circuit no. 333)		35		35	ns	$I_C \cong 10$ mA, $I_{B1} \cong 1.0$ mA, $V_{CC} = -3.0$ V
t_r	Rise Time (test circuit no. 333)		35		35	ns	$I_C \cong 10$ mA, $I_{B1} \cong 1.0$ mA, $V_{CC} = -3.0$ V
t_s	Storage Time (test circuit no. 239)		200		225	ns	$I_C \cong 10$ mA, $I_{B1} \cong 1.0$ mA, $I_{B2} \cong -1.0$ mA, $V_{CC} = -3.0$ V
t_f	Fall Time (test circuit no. 239)		60		75	ns	$I_C \cong 10$ mA, $I_{B1} \cong 1.0$ mA, $I_{B2} \cong -1.0$ mA, $V_{CC} = -3.0$ V
NF	Wide Band Noise Figure		5.0		4.0	dB	$I_C = 100$ μA, $V_{CE} = -5.0$ V, $R_S = 1.0$ kΩ, f = 10 Hz to 15.7 kHz

FAIRCHILD

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2N3946/FTSO3946

NPN Small Signal General Purpose Amplifier & Switch

- V_{CEO} . . . **40 V (Min)**

PACKAGE

2N3946	TO18
FTSO3946	TO236AA

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures	**2N**	**FTSO**
Storage Temperature	-65° C to 200° C	-55° C to 150° C
Operating Junction Temperature	175° C	150° C

Power Dissipation (Notes 2 & 3)		
Total Dissipation at	**2N**	**FTSO**
25° C Ambient Temperature	0.36 mW	0.350 W*
25° C Case Temperature	1.2 W	

Voltages & Currents

		2N	FTSO
V_{CEO}	Collector to Emitter Voltage (Note 4)	40 V	40 V
V_{CBO}	Collector to Base Voltage	60 V	60 V
V_{EBO}	Emitter to Base Voltage	6.0 V	6.0 V
I_C	Collector Current	200 mA	200 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage (Note 4)	40		V	$I_C = 10$ mA, $I_B = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	60		V	$I_C = 10\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	6.0		V	$I_E = 10\ \mu A$, $I_C = 0$
I_{CEX}	Collector Cutoff Current		10 15	nA μA	$V_{CE} = 40$ V, $V_{EB} = 3.0$ V $V_{CE} = 40$ V, $V_{EB} = 3.0$ V, $T_A = 150°$ C
I_{BL}	Base Cutoff Current		25	nA	$V_{CE} = 40$ V, $V_{EB} = 3.0$ V
h_{FE}	DC Current Gain (Note 5)	30 45 50 20	 150 		$I_C = 0.1$ mA, $V_{CE} = 1.0$ V $I_C = 1.0$ mA, $V_{CE} = 1.0$ V $I_C = 10$ mA, $V_{CE} = 1.0$ V $I_C = 50$ mA, $V_{CE} = 1.0$ V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.2 0.3	V V	$I_C = 10$ mA, $I_B = 1.0$ mA $I_C = 50$ mA, $I_B = 5.0$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)	0.6	0.9 1.0	V V	$I_C = 10$ mA, $I_B = 1.0$ mA $I_C = 50$ mA, $I_B = 5.0$ mA

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 2%.
6. For product family characteristic curves, refer to Curve Set T144.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
C_{ob}	Output Capacitance		4.0	pF	V_{CB} = 10 V, I_E = 0, f = 100 kHz
C_{ib}	Input Capacitance		8.0	pF	V_{EB} = 1.0 V, I_C = 0, f = 100 kHz
h_{fe}	Current Gain Bandwidth Product	2.5			I_C = 10 mA, V_{CE} = 20 V, f = 100 MHz
h_{ie}	Input Impedance	0.5	6.0	kΩ	I_C = 1.0 mA, V_{CE} = 10 V, f = 1.0 kHz
h_{oe}	Output Admittance	1.0	30	μmhos	I_C = 1.0 mA, V_{CE} = 10 V, f = 1.0 kHz
h_{re}	Voltage Feedback Ratio		10	$x10^{-4}$	I_C = 1.0 mA, V_{CE} = 10 V, f = 1.0 kHz
t_d	Delay Time (test circuit no. 526)		35	ns	I_C = 10 mA, V_{CC} = 3.0 V, I_{B1} = 1.0 mA, $V_{BE(OFF)}$ = 0.5V
t_r	Rise Time (test circuit no. 526)		300	ns	I_C = 10 mA, V_{CC} = 3.0 V, I_{B1} = 1.0 mA, $V_{BE(OFF)}$ = 0.5V
t_s	Storage Time (test circuit no. 527)		300	ns	I_C = 10 mA, V_{CC} = 3.0 V, I_{B1} = I_{B2} = 1.0 mA
t_f	Fall Time (test circuit no. 527)		75	ns	I_C = 10 mA, V_{CC} = 3.0 V, I_{B1} = I_{B2} = 1.0 mA
$r_b'C_c$	Collector to Base Time Constant		200	ps	I_C = 10 mA, V_{CE} = 20 V, f = 31.8 MHz
NF	Noise Figure		5.0	dB	I_C = 100 μA, V_{CE} = 5.0 V, R_G = 1.0 kΩ, f = 10 Hz to 15.7 kHz

FAIRCHILD

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2N3962/PN3962 FTSO3962

PNP Low Level Low Noise Amplifiers

- **V_{CEO} . . . -60 V (Min)**
- **Excellent Beta Linearity from 1.0 μA to 50 mA**

PACKAGE

2N3962	TO-18
PN3962	TO-92
FTSO3962	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures	**PN/FTSO**	**2N**
Storage Temperature	-55° C to 150° C	-65° C to 200° C
Operating Junction Temperature	150° C	175° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	**2N**	**PN**	**FTSO**
25° C Ambient Temperature	0.36 W	0.625 W	0.350 W*
25° C Case Temperature	1.2 W	1.0 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	–60 V
V_{CBO}	Collector to Base Voltage	–60 V
V_{EBO}	Emitter to Base Voltage	–6.0 V
I_C	Collector Current	200 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CBO}	Collector to Base Breakdown Voltage	–60		V	$I_C = 10\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	–6.0		V	$I_E = 10\ \mu A$, $I_C = 0$
BV_{CES}	Collector to Emitter Breakdown Voltage	–60		V	$I_C = 10\ \mu A$, $I_B = 0$
I_{EBO}	Emitter Cutoff Current		10	nA	$V_{EB} = -4.0$ V, $I_C = 0$
I_{CES}	Collector Reverse Current		10	nA	$V_{CE} = -50$ V, $V_{EB} = 0$
			10	μA	$V_{CE} = -50$ V, $V_{EB} = 0$, $T_A = 150°$ C
h_{FE}	DC Current Gain	60			$I_C = 1.0\ \mu A$, $V_{CE} = -5.0$ V
		100	300		$I_C = 10\ \mu A$, $V_{CE} = -5.0$ V
		100			$I_C = 100\ \mu A$, $V_{CE} = -5.0$ V
		100	450		$I_C = 1.0$ mA, $V_{CE} = -5.0$ V
		40			$I_C = 10\ \mu A$, $V_{CE} = -5.0$ V, $T_A = -55°$ C
			600		$I_C = 1.0$ mA, $V_{CE} = -5.0$ V, $T_A = 100°$ C

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T219.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
h_{FE}	DC Pulse Current Gain (Note 5)	100 90 45			$I_C = 10$ mA, $V_{CE} = -5.0$ V $I_C = 50$ mA, $V_{CE} = -5.0$ V $I_C = 50$ mA, $V_{CE} = -5.0$ V, $T_A = -55°$ C
$V_{CE(sat)}$ $V_{CE(sat)}$	Collector to Emitter Saturation Voltage Collector to Emitter Saturation Voltage (Note 5)		−0.25 −0.4	V V	$I_C = 10$ mA, $I_B = 0.5$ mA $I_C = 50$ mA, $I_B = 5.0$ mA
$V_{BE(sat)}$ $V_{BE(sat)}$	Base to Emitter Saturation Voltage Base to Emitter Saturation Voltage (Note 5)		−0.9 −0.95	V V	$I_C = 10$ mA, $I_B = 0.5$ mA $I_C = 50$ mA, $I_B = 5.0$ mA
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Notes 4 & 5)		−60	V	$I_C = 5.0$ mA, $I_B = 0$
C_{ob}	Open Circuit Output Capacitance		6.0	pF	$V_{CB} = -5.0$ V, $I_E = 0$, f = 1.0 MHz
C_{ib}	Open Circuit Input Capacitance		15	pF	$V_{EB} = -5.0$ V, $I_C = 0$, f = 1.0 MHz
h_{fe}	High Frequency Current Gain	2.0	8.0		$I_C = 0.5$ mA, $V_{CE} = -5.0$ V, f = 20 MHz
h_{fe}	Small Signal Current Gain	100	500		$I_C = 1.0$ mA, $V_{CE} = -5.0$ V, f = 1.0 kHz
h_{ie}	Input Resistance	2.5	17	kΩ	$I_C = 1.0$ mA, $V_{CE} = 5.0$ V, f = 1.0 kHz
h_{oe}	Output Conductance	5.0	40	μmhos	$I_C = 1.0$ mA, $V_{CE} = -5.0$ V, f = 1.0 kHz
h_{re}	Voltage Feedback Ratio		10	$x10^{-4}$	$I_C = 1.0$ mA, $V_{CE} = -5.0$ V, f = 1.0 kHz
NF	Wide Band Noise Figure		3.0	dB	$I_C = 20$ μA, $V_{CE} = -5.0$ V, $R_S = 10$ kΩ, BW = 15.7 Hz, f = 10 Hz to 10 kHz

3

FAIRCHILD

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2N4030/2N4031
2N4032/2N4033

PNP Small Signal General Purpose Amplifiers

- **V_{CEO} ... 60 V (Min) (2N4030/2), 80 V (Min) 2N4031/3)**
- **h_{FE} ... 100-300 @ 10 mA (2N4032/3), 40 (Min) 2N4032), 25 (Min) (2N4033) @ 1.0 A**
- **Complements ... 2N3107, 2N3108, 2N3109, 2N3020**

PACKAGES

2N4030	TO-39
2N4031	TO-39
2N4032	TO-39
2N4033	TO-39

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-65° C to 200° C
Operating Junction Temperature	200° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	
25° C Ambient Temperature	0.8 W
25° C Case Temperature	4.0 W

Voltages & Currents		**4030/2**	**4031/3**
V_{CEO}	Collector to Emitter Voltage (Note 4)	–60 V	–80 V
V_{CBO}	Collector to Base Voltage	–60 V	–80 V
V_{EBO}	Emitter to Base Voltage	–5.0 V	–5.0 V
I_C	Collector Current	1.0 A	1.0 A

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	4030 MIN	4030 MAX	4031 MIN	4031 MAX	UNITS	TEST CONDITIONS
BV_{CBO}	Collector to Base Breakdown Voltage	–60		–80		V	$I_C = 10\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	–5.0		–5.0		V	$I_E = 10\ \mu A$, $I_C = 0$
I_{EBO}	Emitter Cutoff Current		10		10	μA	$V_{EB} = -5.0$ V, $I_C = 0$
I_{CBO}	Collector Cutoff Current		50			nA	$V_{CB} = -50$ V, $I_E = 0$
					50	nA	$V_{CB} = -60$ V, $I_E = 0$
			50			μA	$V_{CB} = -50$ V, $I_E = 0$, $T_A = 150°$ C
					50	μA	$V_{CB} = -60$ V, $I_E = 0$, $T_A = 150°$ C
h_{FE}	DC Current Gain	30		30			$I_C = 100\ \mu A$, $V_{CE} = -5.0$ V

NOTES:
1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 200° C and junction-to-case thermal resistance of 43.7° C/W (derating factor of 22.8 mW/° C); junction-to-ambient thermal resistance of 219° C/W (derating factor of 4.56 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T224.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	4030 MIN	4030 MAX	4031 MIN	4031 MAX	UNITS	TEST CONDITIONS
h_{FE}	DC Pulse Current Gain (Note 5)	40 25 15 15	120	40 25 10 15	120		$I_C = 100$ mA, $V_{CE} = -5.0$ V $I_C = 500$ mA, $V_{CE} = -5.0$ V $I_C = 1.0$ A, $V_{CE} = -5.0$ V $I_C = 100$ mA, $V_{CE} = -5.0$ V, $T_A = -55°$ C
V_{CEO}	Collector to Emitter Sustaining Voltage (Note 5)	−60		−80		V	$I_C = 10$ mA (pulsed), $I_B = 0$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		−0.15 −0.5 1.0		−0.15 −0.5	V V V	$I_C = 150$ mA, $I_B = 15$ mA $I_C = 500$ mA, $I_B = 50$ mA $I_C = 1.0$ A, $I_B = 100$ mA
$V_{BE(ON)}$	Base to Emitter "On" Voltage (Note 5)		−1.1 −1.2		−1.1	V V	$I_C = 500$ mA, $V_{CE} = -0.5$ V $I_C = 1.0$ A, $V_{CE} = -1.0$ V
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)		−0.9		−0.9	V	$I_C = 150$ mA, $I_B = 15$ mA
C_{cb}	Collector to Base Capacitance		20		20	pF	$V_{CB} = -10$ V, $I_E = 0$, f = 1.0 MHz
C_{ib}	Input Capacitance		110		110	pF	$V_{BE} = -0.5$ V, $I_C = 0$, f = 1.0 MHz
$\|h_{fe}\|$	Magnitude of Common Emitter Small Signal Current Gain	1.0	4.0	1.0	4.0		$I_C = 50$ mA, $V_{CE} = -10$ V, f = 100 MHz
t_s	Storage Time (test circuit no. 341)		350		350	ns	$I_C \approx 500$ mA, $I_{B1} \approx -I_{B2} \approx 50$ mA
t_f	Fall Time (test circuit no. 341)		50		50	ns	$I_C \approx 500$ mA, $I_{B1} \approx -I_{B2} \approx 50$ mA
t_{on}	Turn On Time (test circuit no. 341)		100		100	ns	$I_C \approx 500$ mA, $I_{B1} \approx 50$ mA

SYMBOL	CHARACTERISTIC	4032 MIN	4032 MAX	4033 MIN	4033 MAX	UNITS	TEST CONDITIONS
BV_{CBO}	Collector to Base Breakdown Voltage	−60		−80		V	$I_C = 10\ \mu$A, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	−5.0		−5.0		V	$I_E = 10\ \mu$A, $I_C = 0$
I_{EBO}	Emitter Cutoff Current		10		10	μA	$V_{EB} = -5.0$ V, $I_C = 0$
I_{CBO}	Collector Cutoff Current		50 50 		 50 50	nA nA μA μA	$V_{CB} = -50$ V, $I_E = 0$ $V_{CB} = -60$ V, $I_E = 0$ $V_{CB} = -50$ V, $I_E = 0$, $T_A = 150°$ C $V_{CB} = -60$ V, $I_E = 0$, $T_A = 150°$ C
h_{FE}	DC Current Gain	75		75			$I_C = 100\ \mu$A, $V_{CE} = -5.0$ V
h_{FE}	DC Pulse Current Gain (Note 5)	100 70 40 40	300	100 70 25 40	300		$I_C = 100$ mA, $V_{CE} = -5.0$ V $I_C = 500$ mA, $V_{CE} = -5.0$ V $I_C = 1.0$ A, $V_{CE} = -5.0$ V $I_C = 100$ mA, $V_{CE} = -5.0$ V, $T_A = -55°$ C
V_{CEO}	Collector to Emitter Sustaining Voltage (Note 5)	−60		−80		V	$I_C = 10$ mA (pulsed), $I_B = 0$

3

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	4032 MIN	4032 MAX	4033 MIN	4033 MAX	UNITS	TEST CONDITIONS
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		−0.15 −0.5		−0.15 −0.5 −1.0	V V V	$I_C = 150$ mA, $I_B = 15$ mA $I_C = 500$ mA, $I_B = 50$ mA $I_C = 1.0$ A, $I_B = 100$ mA
$V_{BE(ON)}$	Base to Emitter "On" Voltage (Note 5)		−1.1 |1.2		−1.1	V V	$I_C = 500$ mA, $V_{CE} = -0.5$ V $I_C = 1.0$ A, $V_{CE} = -1.0$ V
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)		−0.9		−0.9	V	$I_C = 150$ mA, $I_B = 15$ mA
C_{cb}	Collector to Base Capacitance		20		20	pF	$V_{CB} = -10$ V, $I_E = 0$, $f = 1.0$ MHz
C_{ib}	Input Capacitance		110		110	pF	$V_{BE} = -0.5$ V, $I_C = 0$, $f = 1.0$ MHz
$\|h_{fe}\|$	Magnitude of Common Emitter Small Signal Current Gain	1.5	5.0	1.5	5.0		$I_C = 50$ mA, $V_{CE} = -10$ V, $f = 100$ MHz
t_s	Storage Time (test circuit no. 341)		350		350	ns	$I_C \approx 500$ mA, $I_{B1} \approx I_{B2} \approx 50$ mA
t_f	Fall Time (test circuit no. 341)		50		50	ns	$I_C \approx 500$ mA, $I_{B1} \approx I_{B2} \approx 50$ mA
t_{on}	Turn On Time (see test circuit no. 341)		100		100	ns	$I_C \approx 500$ mA, $I_{B1} \approx 50$ mA

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2N4036/2N4037

PNP General Purpose Transistor

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-65° C to 200° C
Operating Junction Temperature	-65° C to 200° C

Power Dissipation (Notes 2 & 3)

	4036	**4037**
Total Dissipation at 25° C Ambient Temperature	5.0 W	1.0 W

Voltages & Currents (Note 4)

		4036	**4037**
V_{CEO}	Collector to Emitter Voltage	−65 V	−40 V
V_{CBO}	Collector to Base Voltage	−90 V	−60 V
V_{EBO}	Emitter to Base Voltage	−7.0 V	−7.0 V
I_C	Collector Current (Continuous)	1.0 A	1.0 A
I_B	Base Current (Continuous)	0.5 A	0.5 A

PACKAGE

2N4036	TO-39
2N4037	TO-39

3

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	2N4036 MIN	2N4036 MAX	2N4037 MIN	2N4037 MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Sustaining Voltage	−65		−40		V	$I_C = 100$ mA, $I_B = 0$
BV_{CBO}	Collector to Base Breakdown Voltage			−60		V	$I_C = 0.1$ mA
I_{EBO}	Emitter Cutoff Current		10			μA	$V_{EB} = -7.0$ V
					1.0	μA	$V_{EB} = -5.0$ V
I_{CBO}	Collector Cutoff Current		100			μA	$V_{CB} = -90$ V, $I_E = 0$
					0.25	μA	$V_{CB} = -60$ V, $I_E = 0$
I_{CEX}	Collector Cutoff Current		100			mA	$V_{CE} = -85$ V, $V_{BE} = -1.5$ V
			0.1			μA	$V_{CE} = -30$ V, $V_{BE} = -1.5$ V, $T_C = 150°$C
h_{FE}	DC Current Gain (Note 5)	20	200				$I_C = 150$ mA, $V_{CE} = 2.0$ V
		20					$I_C = 100$ μA, $V_{CE} = 10$ V
				15			$I_C = 1.0$ mA, $V_{CE} = 10$ V
		40	140	50	250		$I_C = 150$ mA, $V_{CE} = 10$ V
		20					$I_C = 500$ mA, $V_{CE} = 10$ V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage		−0.65		−1.4	V	$I_C = 150$ mA, $I_B = 15$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)		−1.4			V	$I_C = 150$ mA, $I_B = 15$ mA
$V_{BE(ON)}$	Base to Emitter On Voltage			−1.4		V	$I_C = 150$ mA, $V_{CE} = 10$ V

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 200° C and (2N4036) junction-to-case thermal resistance of 35° C/W (derating factor of 28.6 mW/° C); (2N4037) junction-to-case thermal resistance of 175° C/W (derating factor of 5.71 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs, duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T224.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	2N4036 MIN	2N4036 MAX	2N4037 MIN	2N4037 MAX	UNITS	TEST CONDITIONS
$\lvert h_{fe} \rvert$	High Frequency Current Gain	3.0		3.0	10		$I_C = 50$ mA, $V_{CE} = -10$ V, f = 20 MHz
C_{cb}	Collector to Base Capacitance				30	pF	$V_{CB} = 10$ V, f = 1.0 MHz
t_r	Rise Time		70			ns	$I_C = 150$ mA, $I_{B1} = 15$ mA
t_s	Storage Time		600			ns	$I_C = 150$ mA, $I_{B1} = I_{B2} = 15$ mA
t_f	Fall Time		100			ns	$I_C = 150$ mA, $I_{B1} = I_{B2} = 15$ mA
t_{on}	Turn On Time		110			ns	$I_C = 150$ mA, $I_{B1} = 15$ mA
t_{off}	Turn Off Time		700			ns	$I_C = 150$ mA, $I_{B1} = I_{B2} = 15$ mA

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2N4123/FTSO4123
2N4124/FTSO4124

NPN Small Signal General Purpose Amplifiers & Switches

- **V_{CEO} ... 25 V (Min) (2N/FTSO4124)**
- **h_{FE} ... 120-360 @ 2.0 mA (2N/FTSO4124)**
- **NF ... 5.0 dB (Max) Wide Band (2N/FTSO4124)**
- **Complements ... 2N4125, 2N4126**

PACKAGE	
2N4123	TO-92
2N4124	TO-92
FTSO4123	TO-236AA/AB
FTSO4124	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	**2N**	**FTSO**
25° C Ambient Temperature	0.625 W	0.350 W*
70° C Ambient Temperature	0.400 W	
25° C Case Temperature	1.0 W	

Voltages & Currents		**4123**	**4124**
V_{CEO}	Collector to Emitter Voltage (Note 4)	30 V	25 V
V_{CBO}	Collector to Base Voltage	40 V	30 V
V_{EBO}	Emitter to Base Voltage	5.0 V	5.0 V
I_C	Collector Current	200 mA	200 mA

3

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	4123 MIN	4123 MAX	4124 MIN	4124 MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage (Note 5)	30		25		V	$I_C = 1.0$ mA, $I_B = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	40		30		V	$I_C = 10\ \mu$A, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0		5.0		V	$I_E = 10\ \mu$A, $I_C = 0$
I_{EBO}	Emitter Cutoff Current		50		50	nA	$V_{EB} = 3.0$ V, $I_C = 0$
I_{CBO}	Collector Cutoff Current		50		50	nA	$V_{CB} = 20$ V, $I_E = 0$
h_{FE}	DC Pulse Current Gain (Note 5)	50 25	150	120 60	360		$I_C = 2.0$ mA, $V_{CE} = 1.0$ V $I_C = 50$ mA, $V_{CE} = 1.0$ V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.3		0.3	V	$I_C = 50$ mA, $I_B = 5.0$ mA

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 2%.
6. For product family characteristic curves, refer to Curve Set T144.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	4123 MIN	4123 MAX	4124 MIN	4124 MAX	UNITS	TEST CONDITIONS
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)		0.95		0.95	V	$I_C = 50$ mA, $I_B = 5.0$ mA
C_{cb}	Collector to Base Capacitance		4.0		4.0	pF	$V_{CB} = 5.0$ V, $I_E = 0$, f = 100 kHz
C_{ib}	Input Capacitance		8.0		8.0	pF	$V_{EB} = 0.5$ V, $I_C = 0$, f = 100 kHz
$\lvert h_{fe} \rvert$	Magnitude of Small Signal Current Gain	2.5		3.0			$I_C = 10$ mA, $V_{CE} = 20$ V, f = 100 MHz
h_{fe}	Small Signal Current Gain	50	200	120	480		$I_C = 2.0$ mA, $V_{CE} = 10$ V, f = 1.0 kHz
NF	Noise Figure		6.0		5.0	dB	$I_C = 100$ μA, $V_{CE} = 5.0$ V, f = 10 Hz to 15.7 kHz, $R_S = 1.0$ kΩ

FAIRCHILD

A Schlumberger Company

2N4125/FTSO4125
2N4126/FTSO4126

PNP Small Signal General Purpose Amplifiers & Switches

- **V_{CEO} ... -25 V (Min) (2N/FTSO4126)**
- **h_{FE} ... 120-360 @ 2.0 mA (2N/FTSO4126)**
- **NF ... 4.0 dB (Max) Wide Band (2N/FTSO4126)**
- **Complements ... 2N4123, 2N4124**

PACKAGE

2N4125	TO-92
2N4126	TO-92
FTSO4125	TO-236AA/AB
FTSO4126	TO-236AA/AB

3

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	**2N**	**FTSO**
25° C Ambient Temperature	0.625 W	0.350 W*
70° C Ambient Temperature	0.400 W	
25° C Case Temperature	1.0 W	

Voltages & Currents		**4125**	**4126**
V_{CEO}	Collector to Emitter Voltage (Note 4)	−30 V	−25 V
V_{CBO}	Collector to Base Voltage	−30 V	−25 V
V_{EBO}	Emitter to Base Voltage	−4.0 V	−4.0 V
I_C	Collector Current	200 mA	200 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	4125 MIN	4125 MAX	4126 MIN	4126 MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage (Note 5)	−30		−25		V	$I_C = 1.0$ mA, $I_B = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	−30		−25		V	$I_C = 10\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	−4.0		−4.0		V	$I_E = 10\ \mu A$, $I_C = 0$
I_{EBO}	Emitter Cutoff Current		50		50	nA	$V_{EB} = -3.0$ V, $I_C = 0$
I_{CBO}	Collector Cutoff Current		50		50	nA	$V_{CB} = -20$ V, $I_E = 0$
h_{FE}	DC Pulse Current Gain (Note 5)		150	120	360		$I_C = 2.0$ mA, $V_{CE} = -1.0$ V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		−0.4		−0.4	V	$I_C = 50$ mA, $I_B = 5.0$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)		−0.95		−0.95	V	$I_C = 50$ mA, $I_B = 5.0$ mA

NOTES:
1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 2%.
6. For product family characteristic curves, refer to Curve Set T215.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	4125 MIN	4125 MAX	4126 MIN	4126 MAX	UNITS	TEST CONDITIONS
C_{cb}	Collector to Base Capacitance		4.5		4.5	pF	$V_{CB} = -5.0$ V, $I_E = 0$, f = 100 kHz
C_{ib}	Input Capacitance		10		10	pF	$V_{EB} = -0.5$ V, $I_C = 0$, f = 100 kHz
$\|h_{fe}\|$	Magnitude of Small Signal Current Gain	2.0		2.0			$I_C = 10$ mA, $V_{CE} = -20$ V, f = 100 MHz
h_{fe}	Small Signal Current Gain	50	200	120	480		$I_C = 2.0$ mA, $V_{CE} = -1.0$ V, f = 1.0 kHz
NF	Noise Figure		5.0		4.0	dB	$I_C = 100$ μA, $V_{CE} = -5.0$ V, f = 10 Hz to 15.7 kHz, $R_G = 1.0$ kΩ

FAIRCHILD

A Schlumberger Company

2N4208/FTSO4208
2N4209/FTSO4209

PNP Small Signal Ultra High Speed Saturated Switches

- V_{CEO} ... 15 V (Min) (2N/FTSO4209)
- V_{CE} ... 0.18 V(Max) @ I_C = 10 mA (2N/FTSO4209)
- τ_s ... 20 ns (Max)
- t_{on} ... 15 ns (Max), t_{off} ... 20 ns (Max)
- C_{ob} ... 3.0 pF (Max)
- C_{ib} ... 3.5 pF (Max)
- f_T ... 850 MHz (Min) (2N/FTSO4209)
- Complement ... 2N2369A

PACKAGE

2N4208	TO-18
2N4209	TO-18
FTSO4208	TO-236AA/AB
FTSO4209	TO-236AA/AB

3

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures	**2N**	**FTSO**
Storage Temperature	-65° C to 200° C	-55° C to 150° C
Operating Junction Temperature	200° C	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	**2N**	**FTSO**
25° C Ambient Temperature	0.3 W	0.350 W*
25° C Case Temperature	0.7 W	

Voltages & Currents		**4208**	**4209**
V_{CEO}	Collector to Emitter Voltage (Note 4)	−12 V	−15 V
V_{CBO}	Collector to Base Voltage	−12 V	−15 V
V_{EBO}	Emitter to Base Voltage	−4.5 V	−4.5 V
I_C	Collector Current	50 mA	50 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	4208 MIN	4208 MAX	4209 MIN	4209 MAX	UNITS	TEST CONDITIONS
BV_{CES}	Collector to Emitter Breakdown Voltage	−12		−15		V	I_C = 100 μA, V_{BE} = 0
BV_{CBO}	Collector to Base Breakdown Voltage	−12		−15		V	I_C = 100 μA, I_E = 0
BV_{EBO}	Emitter to Base Breakdown Voltage	−4.5		−4.5		V	I_E = 100 μA, I_C = 0

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 200° C and (TO-92) junction-to-case thermal resistance of 250° C/W (derating factor of 4.0 mW/° C); junction-to-ambient thermal resistance of 583° C/W (derating factor of 1.72 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T292.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	4208 MIN	4208 MAX	4209 MIN	4209 MAX	UNITS	TEST CONDITIONS
I_{CES}	Collector Reverse Current (Note 5)		10			nA	$V_{CE} = -6.0$ V, $V_{BE} = 0$
					10	nA	$V_{CE} = -8.0$ V, $V_{BE} = 0$
			5.0			μA	$V_{CE} = -6.0$ V, $V_{BE} = 0$, $T_A = 125°$ C
					5.0	μA	$V_{CE} = -8.0$ V, $V_{BE} = 0$, $T_A = 125°$ C
h_{FE}	DC Current Gain	15		35			$I_C = 1.0$ mA, $V_{CE} = -0.5$ V
h_{FE}	DC Pulse Current Gain (Note 5)	30	120	50	120		$I_C = 10$ mA, $V_{CE} = -0.3$ V
		30		40			$I_C = 50$ mA, $V_{CE} = -1.0$ V
		12		20			$I_C = 10$ mA, $V_{CE} = -0.3$ V, $T_A = -55°$ C
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Note 5)	−12		−15		V	$I_C = 3.0$ mA, $I_B = 0$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage		−0.13		−0.15	V	$I_C = 1.0$ mA, $I_B = 0.1$ mA
$V_{CE(sat)}$	Pulsed Collector to Emitter Saturation Voltage (Note 5)		−0.15		−0.18	V	$I_C = 10$ mA, $I_B = 1.0$ mA
			−0.5		−0.6	V	$I_C = 50$ mA, $I_B = 5.0$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage		−0.8		−0.8	V	$I_C = 1.0$ mA, $I_B = 0.1$ mA
$V_{BE(sat)}$	Pulsed Base to Emitter Saturation Voltage (Note 5)	−0.8	−0.95	−0.8	−0.95	V	$I_C = 10$ mA, $I_B = 1.0$ mA
			−1.5		−1.5	V	$I_C = 50$ mA, $I_B = 5.0$ mA
C_{ob}	Output Capacitance		3.0		3.0	pF	$V_{CB} = -5.0$ V, $I_E = 0$
C_{ib}	Input Capacitance		3.5		3.5	pF	$V_{BE} = -0.5$ V, $I_C = 0$
h_{fe}	High Frequency Current Gain		7.0		8.5		$I_C = 10$ mA, $V_{CE} = -10$ V, f = 100 MHz
τ_s	Charge Storage Time Constant (test circuit no. 234)		20		20	ns	$I_C = 10$ mA, $I_{B1} = I_{B2} \approx 10$ mA, $V_{CC} = -3.0$ V
t_{on}	Turn On Time (test circuit no. 348)		15		15	ns	$I_C = 10$ mA, $I_{B1} \approx 1.0$ mA, $V_{CC} = -1.5$ V
t_{off}	Turn Off Time (test circuit no. 348)		20		20	ns	$I_C = 10$ mA, $I_{B1} = I_{B2} \approx 1.0$ mA, $V_{CC} = -1.5$ V

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A Schlumberger Company

2N4234/2N4235 2N4236

6 Watt PNP Power

- $V_{CE(sat)}$ ... 0.6 V @ I_C = 1.0 A
- **Complements ... 2N4237 through 2N4239**

PACKAGE

2N4234	TO-39
2N4235	TO-39
2N4236	TO-39

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-65° C to 200° C
Operating Junction Temperature	200° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at 25° C Case Temperature	6.0 W

Voltages & Currents (Note 4)		**4234**	**4235**	**4236**
V_{CEO}	Collector to Emitter Voltage	−40 V	−60 V	−80 V
V_{CBO}	Collector to Base Voltage	−40 V	−60 V	−80 V
V_{EBO}	Emitter to Base Voltage	−7.0 V	−7.0 V	−7.0 V
I_C	Collector Current (Continuous)	1.0 A	1.0 A	1.0 A
I_B	Base Current (Continuous)	0.2 A	0.2 A	0.2 A

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 3)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
I_{EBO}	Emitter Cutoff Current		500	μA	V_{EB} = −7.0 V, I_C = 0
I_{CBO}	Collector Cutoff Current (2N4234)		100	μA	V_{CB} = −40 V, I_E = 0
	(2N4235)		100	μA	V_{CB} = −60 V, I_E = 0
	(2N4236)		100	μA	V_{CB} = −80 V, I_E = 0
I_{CEO}	Collector Cutoff Current (2N4235)		1.0	mA	V_{CE} = −30 V, I_B = 0
	(2N4235)		1.0	mA	V_{CE} = −40 V, I_B = 01
	(2N4236)		1.0	mA	V_{CE} = −60 V, I_B = 0
I_{CEX}	Collector Cutoff Current (2N4234)		100	μA	V_{CE} = −40 V, V_{EB} = −1.5 V
	(2N4234)		1.0	mA	V_{CE} = −30 V, V_{EB} = −1.5 V, T_C = 150° C
	(2N4235)		100	μA	V_{CE} = −60 V, V_{EB} = −1.5 V
	(2N4235)		1.0	mA	V_{CE} = −40 V, V_{EB} = −1.5 V, T_C = 150° C
	(2N4236)		100	μA	V_{CE} = −80 V, V_{EB} = −1.5 V
	(2N4237)		1.0	mA	V_{CE} = −60 V, V_{EB} = −1.5 V, T_C = 150° C

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 200° C and junction-to-case thermal resistance of 33.3° C/W (derating factor of 34 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 2%.
6. For product family characteristic curves, refer to Curve Set T414.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 3)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
h_{FE}	DC Pulse Current Gain (Note 5)	40 30 20 10	 150		$I_C = 100$ mA, $V_{CE} = -1.0$ V $I_C = 250$ mA, $V_{CE} = -1.0$ V $I_C = 500$ mA, $V_{CE} = -1.0$ V $I_C = 1.0$ A, $V_{CE} = -1.0$ V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage Voltage (Note 5)		−0.6	V	$I_C = 1.0$ A, $I_B = 125$ mA
$V_{BE(ON)}$	Base to Emitter "On" Voltage		−1.0	V	$I_C = 250$ mA, $V_{CE} = -1.0$ V
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)		−1.5	V	$I_C = 1.0$ A, $I_B = 100$ mA
C_{ob}	Output Capacitance		100	pF	$V_{CB} = -10$ V, $I_E = 0$, f = 100 kHz
$\|h_{fe}\|$	Magnitude of Common Emitter Small Signal Current Gain	3.0			$I_C = 100$ mA, $V_{CE} = -10$ V, f = 1.0 MHz
h_{fe}	Small Signal Current Gain	25			$I_C = 50$ mA, $V_{CE} = -10$ V, f = 1.0 kHz

FAIRCHILD

A Schlumberger Company

2N4237/2N4238 2N4239

5 Watt NPN Power

- $V_{CE(sat)}$ ... 0.6 V @ I_C = 1.0 A
- **Complements ... 2N4234 through 2N4236**

PACKAGE

2N4237	TO-39
2N4238	TO-39
2N4239	TO-39

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	−55° C to 200° C
Operating Junction Temperature	200° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	
25° C Ambient Temperature	0.8 W
25° C Case Temperature	5.0 W

Voltages & Currents		4237	4238	4239
V_{CEO}	Collector to Emitter Voltage (Note 4)	40 V	60 V	80 V
V_{CBO}	Collector to Base Voltage	50 V	80 V	100 V
V_{EBO}	Emitter to Base Voltage	6.0 V	6.0 V	6.0 V
I_C	Collector Current	1.0 A	1.0 A	1.0 A
I_B	Base Current (Note 2)	0.5 A	0.5 A	0.5 A

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
I_{EBO}	Emitter Cutoff Current		0.5	mA	V_{EB} = 6.0 V, I_C = 0
I_{CBO}	Collector Cutoff Current (4237)		0.1	mA	V_{CB} = 50 V, I_E = 0
	(4238)		0.1	mA	V_{CB} = 80 V, I_E = 0
	(4239)		0.1	mA	V_{CB} = 100 V, I_E = 0
I_{CEO}	Collector Cutoff Current (4237)		1.0	mA	V_{CE} = 30 V, I_B = 0
	(4238)		1.0	mA	V_{CE} = 40 V, I_B = 0
	(4239)		1.0	mA	V_{CE} = 60 V, I_B = 0
I_{CEX}	Collector Cutoff Current (4237)		0.1	mA	V_{CE} = 50 V, V_{EB} = 1.5 V
	(4237)		1.0	mA	V_{CE} = 30 V, V_{EB} = 1.5 V, T_C = 150°C
	(4238)		0.1	mA	V_{CE} = 80 V, V_{EB} = 1.5 V
	(4238)		0.1	mA	V_{CE} = 50 V, V_{EB} = 1.5 V, T_C = 150° C
	(4239)		0.1	mA	V_{CE} = 100 V, V_{EB} = 1.5 V
	(4239)		0.1	mA	V_{CE} = 70 V, V_{EB} = 1.5 V, T_C = 150° C
h_{FE}	DC Pulse Current Gain (Note 5) (4237)	30	150		I_C = 250 mA, V_{CE} = 1.0 V
	(4238)	30			I_C = 500 mA, V_{CE} = 4.0 V
	(4239)	15			I_C = 1.0 A, V_{CE} = 1.0 V

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 200° C and junction-to-case thermal resistance of 35° C/W (derating factor of 28.5 mW/° C); junction-to-ambient thermal resistance of 218.8° C/W (derating factor of 4.5 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 2%.
6. For product family characteristic curves, refer to Curve Set T315,

ELECTRICAL CHARACTERISTICS (25°C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Pulsed) (Note 4)		0.6 0.3	V V	$I_C = 1.0$ A, $I_B = 100$ mA $I_C = 500$ mA, $I_B = 50$ mA
$V_{BE(ON)}$	Base to Emitter "On" Voltage (Pulsed) (Note 4)		1.0	V	$I_C = 250$ mA, $V_{CE} = 1.0$ V
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Pulsed) (Note 4)		1.5	V	$I_C = 1.0$ A, $I_B = 100$ mA
C_{ob}	Output Capacitance		100	pF	$V_{CB} = 10$ V, $I_C = 0$, f = 0.1 MHz
$\|h_{fe}\|$	Magnitude of Common Emitter Small Signal Current Gain	1.0			$I_C = 100$ mA, $V_{CE} = 10$ V, f = 1.0 kHz
h_{fe}	Small Signal Current Gain	30			$I_C = 100$ mA, $V_{CE} = 10$ V, f = 1.0 kHz

FAIRCHILD

A Schlumberger Company

2N4400/FTSO4400
2N4401/FTSO4401

Small Signal General Purpose Amplifiers & Switches

- V_{CEO} ... 40 V (Min)
- h_{FE} ... 100-300 @ 150 mA (2N/FTSO4401); 40 (Min) @ 500 mA (2N/FTSO4401)
- t_{on} ... 35 ns (Max) @ 150 mA
- t_{off} ... 255 ns (Max) @ 150 mA
- Complements ... 2N4402, 2N4403

PACKAGE

2N4400	TO-92
2N4401	TO-92
FTSO4400	TO-236AA/AB
FTSO4401	TO-236AA/AB

3

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	2N	FTSO
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	40 V
V_{CBO}	Collector to Base Voltage	60 V
V_{EBO}	Emitter to Base Voltage	6.0 V
I_C	Collector Current	600 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	4400 MIN	4400 MAX	4401 MIN	4401 MAX	UNITS	TEST CONDITIONS
$BV_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Note 5)	40		40		V	$I_C = 1.0$ mA, $I_B = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	60		60		V	$I_C = 100\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	6.0		6.0		V	$I_E = 100\ \mu A$, $I_C = 0$
I_{CEX}	Collector Cutoff Current		100		100	nA	$V_{CE} = 35$ V, $V_{EB} = 0.4$ V
I_{BL}	Base Reverse Current		100		100	nA	$V_{CE} = 35$ V, $V_{EB} = 0.4$ V

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle $\leqslant$ 2%.
6. For product family characteristic curves, refer to Curve Set T145.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	4400 MIN	4400 MAX	4401 MIN	4401 MAX	UNITS	TEST CONDITIONS
h_{FE}	DC Current Gain	 20 40		20 40 80			$I_C = 100\ \mu A$, $V_{CE} = 1.0$ V $I_C = 1.0$ mA, $V_{CE} = 1.0$ V $I_C = 10$ mA, $V_{CE} = 1.0$ V
h_{FE}	DC Pulse Current Gain (Note 5)	50 20	150	100 40	300		$I_C = 150$ mA, $V_{CE} = 1.0$ V $I_C = 500$ mA, $V_{CE} = 2.0$ V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.4 0.75		0.4 0.75	V V	$I_C = 150$ mA, $I_B = 15$ mA $I_C = 500$ mA, $I_B = 50$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)	0.75	0.95 1.2	0.75	0.95 1.2	V V	$I_C = 150$ mA, $I_B = 15$ mA $I_C = 500$ mA, $I_B = 50$ mA
C_{cb}	Collector to Base Capacitance		6.5		6.5	pF	$V_{CB} = 5.0$ V, $I_E = 0$, f = 100 kHz
C_{eb}	Emitter to Base Capacitance		30		30	pF	$V_{BE} = 0.5$ V, $I_C = 0$, f = 100 kHz
h_{fe}	Small Signal Current Gain	20	250	40	500		$I_C = 1.0$ mA, $V_{CE} = 10$ V, f = 1.0 kHz
h_{ie}	Input Impedance	0.5	7.5	1.0	15	kΩ	$I_C = 1.0$ mA, $V_{CE} = 10$ V, f = 1.0 kHz
h_{oe}	Output Admittance	1.0	30	1.0	30	µmhos	$I_C = 1.0$ mA, $V_{CE} = 10$ V, f = 1.0 kHz
h_{re}	Voltage Feedback Ratio	0.1	8.0	0.1	8.0	$\times 10^{-4}$	$I_C = 1.0$ mA, $V_{CE} = 10$ V, f = 1.0 kHz
f_T	Current Gain Bandwidth Product	200		250		MHz	$I_C = 20$ mA, $V_{CE} = 10$ V, f = 100 MHz
t_d	Turn On Delay Time (test circuit no. 559)		15		15	ns	$I_C = 150$ mA, $V_{CC} = 30$ V, $I_{B1} = 15$ mA
t_r	Rise Time (test circuit no. 559)		20		20	ns	$I_C = 150$ mA, $V_{CC} = 30$ V, $I_{B1} = 15$ mA
t_s	Storage Time (test circuit no. 560)		225		225	ns	$I_C = 150$ mA, $V_{CC} = 30$ V, $I_{B1} = I_{B2} = 15$ mA
t_f	Fall Time (test circuit no. 560)		30		30	ns	$I_C = 150$ mA, $V_{CC} = 30$ V, $I_{B1} = I_{B2} = 15$ mA

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2N4402/FTSO4402
2N4403/FTSO4403

PNP Small Signal General Purpose Amplifiers & Switches

- **V_{CEO} ... -40 V (Min)**
- **h_{FE} ... 100-300 @ 150 mA (2N/FTSO4403), 20 (Min) @ 500 mA (2N/FTSO4403)**
- **t_{on} ... 35 ns (Max) @ 150 mA**
- **t_{off} ... 255 ns (Max) @ 150 mA**
- **Complements ... 2N4400, 2N4401**

PACKAGE

2N4402	TO-92
2N4403	TO-92
FTSO4402	TO-236AA/AB
FTSO4403	TO-236AA/AB

3

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	**2N**	**FTSO**
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	−40 V
V_{CBO}	Collector to Base Voltage	−40 V
V_{EBO}	Emitter to Base Voltage	−5.0 V
I_C	Collector Current	600 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	4402 MIN	4402 MAX	4403 MIN	4403 MAX	UNITS	TEST CONDITIONS
$BV_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Note 5)	−40		−40		V	$I_C = 1.0$ mA, $I_B = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	−40		−40		V	$I_C = 100$ μA, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	−5.0		−5.0		V	$I_E = 100$ μA, $I_C = 0$
I_{CEX}	Collector Reverse Current		100		100	nA	$V_{CE} = -35$ V, $V_{EB} = -0.4$ V
I_{BL}	Base Reverse Current		100		100	nA	$V_{CE} = -35$ V, $V_{EB} = -0.4$ V

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle < 2%.
6. For product family characteristic curves, refer to Curve Set T212.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	4402 MIN	4402 MAX	4403 MIN	4403 MAX	UNITS	TEST CONDITIONS
h_{FE}	DC Current Gain	 30 50		30 60 100			$I_C = 100\ \mu A$, $V_{CE} = 1.0$ V $I_C = 1.0$ mA, $V_{CE} = -1.0$ V $I_C = 10$ mA, $V_{CE} = -1.0$ V
h_{FE}	DC Pulse Current Gain (Note 5)	50 20	150	100 20	300		$I_C = 150$ mA, $V_{CE} = -2.0$ V $I_C = 500$ mA, $V_{CE} = -2.0$ V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		−0.4 −0.75		−0.4 −0.75	V V	$I_C = 150$ mA, $I_B = 15$ mA $I_C = 500$ mA, $I_B = 50$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)	−0.75	−0.95 −1.3	−0.75	−0.95 −1.3	V V	$I_C = 150$ mA, $I_B = 15$ mA $I_C = 500$ mA, $I_B = 50$ mA
C_{cb}	Collector to Base Capacitance		8.5		8.5	pF	$V_{CB} = -10$ V, $I_E = 0$, $f = 140$ kHz
C_{eb}	Emitter to Base Capacitance		30		30	pF	$V_{EB} = -0.5$ V, $I_C = 0$, $f = 140$ kHz
h_{fe}	Small Signal Current Gain	30	250	60	500		$I_C = 1.0$ mA, $V_{CE} = -10$ V, $f = 1.0$ kHz
h_{ie}	Input Impedance	0.75	7.5	1.5	15	kΩ	$I_C = 1.0$ mA, $V_{CE} = -10$ V, $f = 1.0$ kHz
h_{oe}	Output Admittance	1.0	100	1.0	100	μmhos	$I_C = 1.0$ mA, $V_{CE} = -10$ V, $f = 1.0$ kHz
h_{re}	Voltage Feedback Ratio	0.1	8.0	0.1	8.0	$\times 10^{-4}$	$I_C = 1.0$ mA, $V_{CE} = -10$ V, $f = 1.0$ kHz
f_T	Current Gain Bandwidth Product	150		200		MHz	$I_C = 20$ mA, $V_{CE} = -10$ V, $f = 100$ MHz
t_d	Turn On Delay Time (test circuit no. 557)		15		15	ns	$I_C = 150$ mA, $V_{CC} = -30$ V, $I_{B1} = 15$ mA
t_r	Rise Time (test circuit no. 557)		20		20	ns	$I_C = 150$ mA, $V_{CC} = -30$ V, $I_{B1} = 15$ mA
t_s	Storage Time (test circuit no. 558)		225		225	ns	$I_C = 150$ mA, $V_{CC} = -30$ V, $I_{B1} = I_{B2} = 15$ mA
t_f	Fall Time (test circuit no. 558)		30		30	ns	$I_C = 150$ mA, $V_{CC} = -30$ V, $I_{B1} = I_{B2} = 15$ mA

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2N4409/FTSO4409
2N4410/FTSO4410

NPN Neon Display Tube Drivers

- V_{CEO} ... **80 V (Min) (2N/FTSO4410)**
- h_{FE} ... **60 V (Min) @ 1.0 and 10 mA**
- **Complements ... MPSA55, MPSA56**

PACKAGE

2N4409	TO-92
2N4410	TO-92
FTSO4409	TO-236AA/AB
FTSO4410	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	**2N**	**FTSO**
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents		**4409**	**4410**
V_{CEO}	Collector to Emitter Voltage (Note 4)	50 V	80 V
V_{CBO}	Collector to Base Voltage	80 V	120 V
V_{EBO}	Emitter to Base Voltage	5.0 V	5.0 V
I_C	Collector Current	250 mA	250 mA

3

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	4409 MIN	4409 MAX	4410 MIN	4410 MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage	50		80		V	$I_C = 1.0$ mA, $I_B = 0$
BV_{CEX}	Collector to Emitter Breakdown Voltage	80		120		V	$I_C = 500\ \mu A$, $V_{BB} = -5.0$ V, $R_{BE} = 8.2\ k\Omega$
BV_{CBO}	Collector to Base Breakdown Voltage	80		120		V	$I_C = 10\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0		5.0		V	$I_E = 10\ \mu A$, $I_C = 0$
I_{EBO}	Emitter Cutoff Current		100		100	nA	$V_{EB} = 4.0$ V, $I_C = 0$

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T147.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	4409 MIN	4409 MAX	4410 MIN	4410 MAX	UNITS	TEST CONDITIONS
I_{CBO}	Collector Cutoff Current		10			nA	$V_{CB} = 60$ V, $I_E = 0$
					10	nA	$V_{CB} = 100$ V, $I_E = 0$
			1.0			μA	$V_{CB} = 60$ V, $I_E = 0$, $T_A = 100°$ C
					1.0	μA	$V_{CB} = 100$ V, $I_E = 0$, $T_A = 100°$ C
h_{FE}	DC Current Gain	60		60			$I_C = 1.0$ mA, $V_{CE} = 1.0$ V
h_{FE}	DC Pulse Current Gain (Note 5)	60	400	60	400		$I_C = 10$ mA, $V_{CE} = 1.0$ V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage		0.2		0.2	V	$I_C = 1.0$ mA, $I_B = 0.1$ mA
$V_{BE(ON)}$	Base to Emitter "On" Voltage		0.8		0.8	V	$I_C = 1.0$ mA, $V_{CE} = 5.0$ V
$V_{BE(sat)}$	Base to Emitter Saturation Voltage		0.8		0.8	V	$I_C = 1.0$ mA, $I_B = 0.1$ mA
C_{cb}	Collector to Base Capacitance		12		12	pF	$V_{CB} = 10$ V, $I_E = 0$, f = 140 kHz
C_{eb}	Emitter to Base Capacitance		50		50	pF	$V_{EB} = 0.5$ V, $I_C = 0$, f = 100 kHz
$\|h_{fe}\|$	Magnitude of Common Emitter Small Signal Current Gain	2.0	10	2.0	10		$I_C = 10$ mA, $V_{CE} = 10$ V, f = 30 MHz

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2N4896

NPN Power

- $V_{CE(sat)}$ . . . 0.7 V @ I_C = 2.0 A
- Low Leakage . . . I_{CES} $^{(Max)}$ μ ^{100} μA @ T_C = 150° C

PACKAGE

2N4896	TO-39

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-65° C to 200° C
Operating Junction Temperature	200° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	
25° C Ambient Temperature	0.8 W
25° C Case Temperature	
100° C Case Temperature	4.0 W

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	60 V
V_{CBO}	Collector to Base Voltage	120 V
V_{EBO}	Emitter to Base Voltage	6.0 V
I_C	Collector Current	5.0 A
I_B	Base Current	1.0 A

3

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 7)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
I_{EBO}	Emitter Cutoff Current		1.0 1.0	μA mA	V_{EB} = 4.0 V, I_E = 0 V_{EB} = 6.0 V, I_C = 0
I_{CES}	Collector Cutoff Current		0.1 1.0 1.0	mA mA μA	V_{CE} = 60 V, V_{BE} = 0, T_A = 150° C V_{CE} = 120 V, V_{BE} = 0 V_{CE} = 60 V, V_{BE} = 0
h_{FE}	DC Current Gain (Note 5)	100 35	300		I_C = 2.0 A, V_{CE} = 2.0 V I_C = 2.0 A, V_{CE} = 2.0 V, T_A = −55° C
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Notes 4 & 5)	60		V	I_C = 50 mA, I_B = 0
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Notes 5 & 6))		1.0	V	I_C = 5.0 mA, I_B = 0.5 A
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Notes 5 & 6)		1.6	V	I_C = 5.0 mA, I_B = 0.5 A

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 200° C and junction-to-case thermal resistance of 25° C/W (derating factor of 40 mW/° C); junction-to-ambient thermal resistance of 219° C/W (derating factor of 4.57 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. Point of measurement: 1/4" from header.
7. For product family characteristic curves, refer to Curve Set T145.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 7)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
C_{ob}	Output Capacitance		80	pF	$V_{CB} = 10$ V, $I_E = 0$, f = 0.14 MHz
C_{ib}	Input Capacitance		500	pF	$V_{EB} = 0.5$ V, $I_C = 0$, f = 0.14 MHz
$\|h_{fe}\|$	Magnitude of Common Emitter Small Signal Current Gain	4.0			$I_C = 0.5$ A, $V_{CE} = 5.0$ V, f = 20 MHz
t_d	Turn On Delay Time		50	ns	$I_C = 5.0$ A, $I_{B1} = 0.5$ A
t_r	Rise Time		300	ns	$I_C = 5.0$ A, $I_{B1} = 0.5$ A
t_s	Storage Time		350	ns	$I_C = 5.0$ A, $I_{B1} = I_{B2} = 0.5$ A
t_f	Fall Time		300	ns	$I_C = 5.0$ A, $I_{B1} = I_{B2} = 0.5$ A

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2N5086/FTSO5086
2N5087/FTSO5087

PNP Low Level Low Noise High Gain Amplifiers

- **V_{CEO} ... -50 V (Min)**
- **h_{FE} ... 250 (Min) from 100 μA to 10 mA (2N/FTSO5087)**
- **NF ... 2.0 dB (Max) Wide Band and 1.0 kHz (2N/FTSO5087)**
- **Complements ... 2N5209, 2N5210**

PACKAGE

2N5086	TO-92
2N5087	TO-92
FTSO5086	TO-236AA/AB
FTSO5087	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	2N	FTSO
25° C Ambient Temperature	1.0 W	0.350 W*
70° C Ambient Temperature	0.400 W	
25° C Case Temperature	0.625 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	−50 V
V_{CBO}	Collector to Base Voltage	−50 V
V_{EBO}	Emitter to Base Voltage	−3.0 V
I_C	Collector Current (Peak)	100 mA
I_C	Collector Current (Continuous)	50 mA

3

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	5086 MIN	5086 MAX	5087 MIN	5087 MAX	UNITS	TEST CONDITIONS
$BV_{CEO(sat)}$	Collector to Emitter Breakdown Voltage	−50		−50		V	I_C = 1.0 mA, I_B = 0
BV_{CBO}	Collector to Base Breakdown Voltage	−50		−50		V	I_C = 100 μA, I_E = 0
I_{EBO}	Emitter Cutoff Current		50		50	nA	V_{EB} = −3.0 V, I_C = 0
I_{CBO}	Collector Cutoff Current		10 50		10 50	nA nA	V_{CB} = −10 V, I_E = 0 V_{CB} = −35 V, I_E = 0
h_{FE}	DC Current Gain	150 150	500	250 250	800		I_C = 100 μA, V_{CE} = −5.0 V I_C = 1.0 mA, V_{CE} = −5.0 V
h_{FE}	DC Pulse Current Gain (Note 5)	150		250			I_C = 10 mA, V_{CE} = −5.0 V

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T219.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	5086 MIN	5086 MAX	5087 MIN	5087 MAX	UNITS	TEST CONDITIONS
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		−0.3		−0.3	V	I_C = 10 mA, I_B = 1.0 mA
$V_{BE(ON)}$	Base to Emitter "On" Voltage (Note 5)		−0.85		−0.85	V	I_C = 1.0 mA, V_{CE} = −5.0 V
C_{cb}	Output Capacitance		4.0		4.0	pF	V_{CB} = −5.0 V, I_E = 0, f = 100 kHz
h_{fe}	Small Signal Current Gain	150	600	250	900		I_C = 1.0 mA, V_{CE} = −5.0 V, f = 1.0 kHz
f_T	Current Gain Bandwidth Product	40		40		MHz	I_C = 500 μA, V_{CE} = −5.0 V, f = 20 MHz
NF	Noise Figure		3.0		2.0	dB	I_C = 20 μA, V_{CE} = −5.0 V, f = 10 to 15.7 kHz, R_S = 10 kΩ
			3.0		2.0	dB	I_C = 100 μA, V_{CE} = −5.0 V, f = 1.0 kHz, R_S = 3.0 kΩ

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2N5088/FTSO5088
2N5089/FTSO5089

NPN Low Level Low Noise High Gain Amplifiers

- V_{CEO} ... **25 V (Min) (2N/FTSO5089)**
- h_{FE} ... **400 (Min) from 100 μA to 10 mA (2N/FTSO5089)**
- **NF ... 2.0 dB (Max) Wide Band**
- **Complements ... 2N5086, 2N5087**

PACKAGE

2N5088	TO-92
2N5089	TO-92
FTSO5088	TO-236AA/AB
FTSO5089	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures	
Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)		
Total Dissipation at	**2N**	**FTSO**
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents		**5088**	**5089**
V_{CEO}	Collector to Emitter Voltage (Note 4)	30 V	25 V
V_{CBO}	Collector to Base Voltage	35 V	30 V
V_{EBO}	Emitter to Base Voltage	4.5 V	4.5 V
I_C	Collector Current	50 mA	50 mA

3

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	5086 MIN	5086 MAX	5087 MIN	5087 MAX	UNITS	TEST CONDITIONS
$BV_{CEO(sus)}$	Collector to Emitter Sustaining Voltage	30		25		V	$I_C = 1.0$ mA, $I_E = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	35		30		V	$I_C = 100$ μA, $I_E = 0$
I_{EBO}	Emitter Cutoff Current		50 100		50 100	nA nA	$V_{EB} = 3.0$ V, $I_C = 0$ $V_{EB} = 4.5$ V, $I_C = 0$
I_{CBO}	Collector Cutoff Current		50		 50	nA nA	$V_{CB} = 20$ V, $I_E = 0$ $V_{CB} = 15$ V, $I_E = 0$
h_{FE}	DC Current Gain (Note 5)	300 350 300	900	400 450 400	1200		$I_C = 100$ μA, $V_{CE} = 5.0$ V $I_C = 1.0$ mA, $V_{CE} = 5.0$ V $I_C = 10$ mA, $V_{CE} = 5.0$ V

NOTES:
1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T155.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	5086 MIN	5086 MAX	5087 MIN	5087 MAX	UNITS	TEST CONDITIONS
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.5		0.5	V	$I_C = 10$ mA, $I_B = 1.0$ mA1
$V_{BE(ON)}$	Base to Emitter "On" Voltage (Note 5)		0.8		0.8	V	$I_C = 10$ mA, $V_{CE} = 5.0$ V
C_{cb}	Collector to Base Capacitance		4.0		4.0	pF	$V_{CB} = 5.0$ V, $I_E = 0$, f = 100 kHz
C_{eb}	Emitter to Base Capacitance		10		10	pF	$V_{BE} = 0.5$ V, $I_C = 0$, f = 100 kHz
h_{fe}	Small Signal Current Gain	350	1400	450	1800		$I_C = 1.0$ mA, $V_{CE} = 5.0$ V, f = 1.0 kHz
f_T	Current Gain Bandwidth Product Product	50		50		MHz	$I_C = 500$ μA, $V_{CE} = 5.0$ V, f = 20 MHz
NF	Noise Figure		3.0		2.0	dB	$I_C = 100$ μA, $V_{CE} = 5.0$ V, $R_S = 10$ kΩ, f = 10 Hz to 15.7 kHz

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2N5209/FTSO5209
2N5210/FTOS5210

NPN Low Level Low Noise High Gain Amplifiers

- V_{CEO} ... **50 V (Min)**
- h_{FE} ... **200 (Min) @ 100 μA, 250 (Min) @ 1.0 mA and 10 mA (2N5210)**
- **NF ... 2.0 dB (Max) Wide Band (2N5210)**
- **Complement ... 2N5086, 2N5087**

PACKAGE

2N5209	TO-92
2N5210	TO-92
FTSO5209	TO-236AA/AB
FTSO5210	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	2N	FTSO
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	50 V
V_{CBO}	Collector to Base Voltage	50 V
V_{EBO}	Emitter to Base Voltage	4.5 V
I_C	Collector Current	50 mA

3

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	5209 MIN	5209 MAX	5210 MIN	5210 MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage	50		50		V	$I_C = 1.0$ mA, $I_B = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	50		50		V	$I_C = 100$ μA, $I_E = 0$
I_{EBO}	Emitter Cutoff Current		50 100		50 100	nA nA	$V_{EB} = 3.0$ V, $I_C = 0$ $V_{EB} = 4.5$ V, $I_C = 0$

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle < 2%.
6. For product family characteristic curves, refer to Curve Set T155.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	5209 MIN	5209 MAX	5210 MIN	5210 MAX	UNITS	TEST CONDITIONS
I_{CBO}	Collector Cutoff Current		50 10		50 10	nA nA	V_{CB} = 35 V, I_E = 0 V_{CB} = 10 V, I_E = 0
h_{FE}	DC Current Gain (Note 5)	100 150 150	300	200 250 250	600		I_C = 100 μA, V_{CE} = 5.0 V I_C = 1.0 mA, V_{CE} = 5.0 V I_C = 10 mA, V_{CE} = 5.0 V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.7		0.7	V	I_C = 10 mA, I_B = 1.0 mA
$V_{BE(ON)}$	Base to Emitter "On" Voltage		0.85		0.85	V	I_C = 1.0 mA, V_{CE} = 5.0 V
C_{cb}	Collector to Base Capacitance		4.0		4.0	pF	V_{CB} = 5.0 V, I_E = 0, f = 100 kHz
h_{fe}	Small Signal Current Gain	150	600	250	900		I_C = 1.0 mA, V_{CE} = 5.0 V, f = 1.0 kHz
f_T	Current Gain Bandwidth Product	30		30		MHz	I_C = 500 μA, V_{CE} = 5.0 V, f = 20 MHz
NF	Noise Figure		3.0 4.0		2.0 3.0	dB dB	I_C = 20 μA, V_{CE} = 5.0 V, R_S = 22 kΩ, f = 10Hz to 15.7kHz I_C = 20 μA, V_{CE} = 5.0 V, R_S = 10 kΩ, f = 1.0 kHz

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2N5220/FTSO5220

NPN Small Signal General Purpose Complementary Amplifiers

- V_{CEO} ... **15 V (Min)**
- h_{FE} ... **30-600 @ 50 mA**
- $V_{CE(sat)}$ ... **0.5 V (max) @ 150 mA**

PACKAGE

2N5220	TO92-1
FTSO5220	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	**2N**	**FTSO**
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	15 V
V_{CBO}	Collector to Base Voltage	15 V
V_{EBO}	Emitter to Base Voltage	3.0 V
I_C	Collector Current	500 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage (Note 5)	15		V	$I_C = 10$ mA, $I_B = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	15		V	$I_C = 100\ \mu$A, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	3.0		V	$I_E = 100\ \mu$A, $I_C = 0$
I_{EBO}	Emitter Cutoff Current		100	nA	$V_{EB} = 3.0$ V, $I_C = 0$
I_{CBO}	Collector Cutoff Current		100	nA	$V_{CB} = 10$ V, $I_E = 0$
h_{FE}	DC Current Gain (Note 5)	25 30	 600		$I_C = 10$ mA, $V_{CE} = 10$ V $I_C = 50$ mA, $V_{CE} = 10$ V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.5	V	$I_C = 150$ mA, $I_B = 15$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)		1.1	V	$I_C = 150$ mA, $I_B = 15$ mA
C_{cb}	Collector to Base Capacitance		10	pF	$V_{CB} = 5.0$ V, $I_E = 0$, f = 1.0 MHz
h_{fe}	Small Signal Current Gain	30	1800		$I_C = 50$ mA, $V_{CE} = 10$ V, f = 1.0 kHz
f_T	Current Gain Bandwidth Product	100		MHz	$I_C = 20$ mA, $V_{CE} = 10$ V

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle < 2%.
6. For product family characteristic curves, refer to Curve Set T145.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

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2N5223/FTSO5223

NPN Small Signal General Purpose Amplifier & Oscillator

- **P_D ... 625 mW @ T_A = 25° C**
- **V_{CEO} ... 20 V (Min)**
- **h_{FE} ... 50-800 @ 2.0 mA**
- **f_T ... 150 MHz (Min) @ 10 mA**
- **C_{cb} ... 4.0 pF (Max)**
- **Complement ... 2N/FTSO5227**

PACKAGE

2N5223	TO-92
FTSO5223	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	**2N**	**FTSO**
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	20 V
V_{CBO}	Collector to Base Voltage	25 V
V_{EBO}	Emitter to Base Voltage	3.0 V
I_C	Collector Current	100 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage	20		V	I_C = 1.0 mA, I_B = 0
BV_{CBO}	Collector to Base Breakdown Voltage	25		V	I_C = 100 μA, I_E = 0
BV_{EBO}	Emitter to Base Breakdown Voltage	3.0		V	I_E = 100 μA, I_C = 0
I_{EBO}	Emitter Cutoff Current		500	nA	V_{EB} = 2.0 V, I_C = 0
I_{CBO}	Collector Cutoff Current		100	nA	V_{CB} = 10 V, I_E = 0
h_{FE}	DC Current Gain	50	800		I_C = 2.0 mA, V_{CE} = 10 V

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle < 2%.
6. For product family characteristic curves, refer to Curve Set T144.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.7	V	$I_C = 10$ mA, $I_B = 1.0$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)		1.2	V	$I_C = 10$ mA, $I_B = 1.0$ mA
C_{cb}	Collector to Base Capacitance		4.0	pF	$V_{CB} = 10$ V, $I_E = 0$, f = 1.0 MHz
h_{fe}	Small Signal Current Gain	50	1600		$I_C = 2.0$ mA, $V_{CE} = 10$ V, f = 1.0 kHz
f_T	Current Gain Bandwidth Product	150		MHz	$I_C = 10$ mA, $V_{CE} = 10$ V, f = 100 MHz

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2N5224/FTSO5224

NPN Low Level Switch

- V_{CEO} ... **12 V (Min)**
- t_{on} ... **45 ns (Max) @ 10 mA**
- t_{off} ... **60 ns (Max) @ 10 mA**
- f_T ... **250 MHz (Min) @ 10 mA**
- C_{cb} ... **4.0 pF (Max)**
- **Complement ... MPSL08**

PACKAGE

2N5224	TO-92
FTSO5224	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	2N	FTSO
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	12 V
V_{CBO}	Collector to Base Voltage	25 V
V_{EBO}	Emitter to Base Voltage	5.0 V
I_C	DC Collector Current	100 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage (Note 5)	12		V	$I_C = 10$ mA, $I_B = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	25		V	$I_C = 100\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0		V	$I_E = 100\ \mu A$, $I_C = 0$
I_{EBO}	Emitter Cutoff Current		100	μA	$V_{EB} = 4.0$ V, $I_C = 0$
I_{CBO}	Collector Cutoff Current		500	nA	$V_{CB} = 15$ V, $I_E = 0$
h_{FE}	DC Current Gain (Note 5)	40 15	400		$I_C = 10$ mA, $V_{CE} = 1.0$ V $I_C = 100$ mA, $V_{CE} = 1.0$ V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.35	V	$I_C = 10$ mA, $I_B = 3.0$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)		0.9	V	$I_C = 10$ mA, $I_B = 3.0$ mA

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle $< 2\%$.
6. For product family characteristic curves, refer to Curve Set T162.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
C_{cb}	Collector to Base Capacitance		4.0	pF	$V_{CB} = 5.0$ V, $I_E = 0$, f = 1.0 MHz
f_T	Current Gain Bandwidth Product	250		MHz	$I_C = 10$ mA, $V_{CE} = 10$ V, f = 100 MHz
t_d	Delay Time (test circuit no. 531)		25	ns	$I_C = 10$ mA, $V_{CC} = 3.0$ V, $I_{B1} = 3.0$ mA
t_r	Rise Time (test circuit no. 531)		20	ns	$I_C = 10$ mA, $V_{CC} = 3.0$ V, $I_{B1} = 3.0$ mA
t_s	Storage Time (test circuit no. 531)		35	ns	$I_C = 10$ mA, $V_{CC} = 3.0$ V, $I_{B1} = I_{B2} = 3.0$ mA
t_f	Fall Time (test circuit no. 531)		25	ns	$I_C = 10$ mA, $V_{CC} = 3.0$ V, $I_{B1} = I_{B2} = 3.0$ mA

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2N5225/FTSO5225
2N5226/FTOS5226

NPN-PNP Small Signal General Purpose Complementary Amplifiers

- V_{CEO} ... **25 V (Min)**
- h_{FE} ... **30-600 @ 50 mA**
- $V_{CE(sat)}$ ... **0.8 V (Max) @ 100 mA**
- **Complement ... 2N5225 (NPN), 2N5226 (PNP)**

PACKAGE

2N5225	TO-92
2N5226	TO-92
FTSO5225	TO-236AA/AB
FTSO5226	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	−55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	**2N**	**FTSO**
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents

		5225	**5226**
V_{CEO}	Collector to Emitter Voltage (Note 4)	25 V	−25 V
V_{CBO}	Collector to Base Voltage	25 V	−25 V
V_{EBO}	Emitter to Base Voltage	4.0 V	−4.0 V
I_C	Collector Current	500 mA	500 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	2N5225 MIN	2N5225 MAX	2N5226 MIN	2N5226 MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage	25		−25		V	$I_C = 10$ mA, $I_B = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	25		−25		V	$I_C = 100\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	4.0		−4.0		V	$I_E = 100\ \mu A$, $I_C = 0$
I_{EBO}	Emitter Cutoff Current		500		500	nA	$V_{EB} = 4.0$ V, $I_C = 0$
I_{CBO}	Collector Cutoff Current		300		300	nA	$V_{CB} = 15$ V, $I_E = 0$
h_{FE}	DC Current Gain (Note 5)	25 30	 600	25 30	 600		$I_C = 10\ \mu A$, $V_{CE} = 10$ V $I_C = 50$ mA, $V_{CE} = 10$ V

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 2%.
6. For product family characteristic curves, refer to Curve Set T145 for 2N5225 and T212 for 2N5226.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	2N5225 MIN	2N5225 MAX	2N5226 MIN	2N5226 MAX	UNITS	TEST CONDITIONS
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.8		–0.8	V	I_C = 100 mA, I_B = 10 mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)		1.0		–1.0	V	I_C = 100 mA, I_B = 10 mA
C_{cb}	Collector to Base Capacitance		20		20	pF	V_{CB} = 5.0 V, I_E = 0, f = 1.0 MHz
h_{fe}	Small Signal Current Gain	30	1800	30	1800		I_C = 50 mA, V_{CE} = 10 V, f = 1.0 kHz
f_T	Current Gain Bandwidth Product		50		50	MHz	I_C = 20 mA, V_{CE} = 10 V, f = 20 MHz

3

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2N5227/FTSO5227

PNP Small Signal General Purpose Amplifier & Oscillator

- **V_{CEO} . . . 30 V (Min)**
- **h_{FE} . . . 50-700 @ 2.0 mA**
- **f_T . . . 100 MHz (Min) @ 10 mA**
- **C_{cb} . . . 5.0 pF (Max)**
- **Complements . . . 2N5223**

PACKAGES

2N5227	TO-92
FTSO5227	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	**2N**	**FTSO**
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	−30 V
V_{CBO}	Collector to Base Voltage	−30 V
V_{EBO}	Emitter to Base Voltage	−3.0 V
I_C	Collector Current	50 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage	−30		V	$I_C = 1.0$ mA, $I_B = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	−30		V	$I_C = 100\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	−3.0		V	$I_E = 100\ \mu A$, $I_C = 0$
I_{EBO}	Emitter Cutoff Current		500	nA	$V_{EB} = -2.0$ V, $I_C = 0$
I_{CBO}	Collector Cutoff Current		100	nA	$V_{CB} = -10$ V, $I_E = 0$
h_{FE}	DC Current Gain (Note 5)	30 50	 700		$I_C = 100\ \mu A$, $V_{CE} = -10$ V $I_C = 2.0$ mA, $V_{CE} = -10$ V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage		−0.4	V	$I_C = 10$ mA, $I_B = 1.0$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage		−1.0	V	$I_C = 10$ mA, $I_B = 1.0$ mA
C_{cb}	Collector to Base Capacitance		5.0	pF	$V_{CB} = 10$ V, $I_E = 0$, f = 1.0 MHz
h_{fe}	Small Signal Current Gain	50	1500		$I_C = 2.0$ mA, $V_{CE} = -10$ V, f = 1.0 kHz
f_T	Current Gain Bandwidth Product	100		MHz	$I_C = 10$ mA, $V_{CE} = -10$ V, f = 100 MHz

NOTES:
1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T215.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

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2N5228/FTSO5228

PNP Low Level Switch

- **V_{CEO} . . . −5.0 V (Min)**
- **t_{on} . . . 75 ns (Max) @ 10 mA**
- **t_{off} . . . 140 ns (Max) @ 10 mA**
- **f_T . . . 300 MHz (Min) @ 10 mA**
- **C_{cb} . . . 5.0 pF (Max)**
- **Complement . . . 2N5224**

PACKAGE

2N5228	TO-92
FTSO5228	TO-236AA/AB

3

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	−55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	**2N**	**FTSO**
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents

V_{CES}	Collector to Emitter Voltage	−6.0 V
V_{CEO}	Collector to Emitter Voltage	−5.0 V
V_{CBO}	Collector to Base Voltage	−5.0 V
V_{EBO}	Emitter to Base Voltage	−3.0 V
I_C	DC Collector Current	50 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 5)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage (Note 4)	−5.0		V	$I_C = 10$ mA, $I_B = 0$
BV_{CES}	Collector to Emitter Breakdown Voltage	−6.0		V	$I_C = 100\ \mu A$, $V_{BE} = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	−5.0		V	$I_C = 100\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	−3.0		V	$I_E = 100\ \mu A$, $I_C = 0$
I_{CES}	Collector Cutoff Current		100	nA	$V_{CE} = -4.0$ V, $V_{BE} = 0$
I_{EBO}	Emitter Cutoff Current		100	μA	$V_{EB} = -2.5$ V, $I_C = 0$
h_{FE}	DC Current Gain (Note 4)	30 15			$I_C = 10$ mA, $V_{CE} = -0.3$ V $I_C = 50$ mA, $V_{CE} = -1.0$ V

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Pulse conditions: length = 300 μs; duty cycle ≤ 2%.
5. For product family characteristic curves, refer to Curve Set T292.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 5)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 4)		−0.4	V	$I_C = 10$ mA, $I_B = 3.0$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 4)	−0.65	−1.25	V	$I_C = 10$ mA, $I_B = 3.0$ mA
C_{cb}	Collector to Base Capacitance		5.0	pF	$V_{CB} = -5.0$ V, $I_E = 0$, f = 1.0 MHz
f_T	Current Gain Bandwidth Product	300		MHz	$I_C = 10$ mA, $V_{CE} = -5.0$ V, f = 100 MHz
t_d	Delay Time (test circuit no. 532)		25	ns	$I_C \approx 10$ mA, $V_{CC} = -3.0$ V, $I_{B1} \approx 3.0$ mA
t_r	Rise Time (test circuit no. 532)		50	ns	$I_C \approx 10$ mA, $V_{CC} = -3.0$ V, $I_{B1} \approx 3.0$ mA
t_s	Storage Time (test circuit no. 532)		90	ns	$I_C \approx 10$ mA, $V_{CC} = -3.0$ V, $I_{B1} \approx -I_{B2} = 3.0$ mA
t_f	Fall Time (test circuit no. 532)		50	ns	$I_C \approx 10$ mA, $V_{CC} = -3.0$ V, $I_{B1} \approx -I_{B2} \approx 3.0$ mA

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2N5320/2N5321
2N5322/2N5323

10 Watt NPN-PNP Silicon Power

- $V_{CE(sat)}$ ... **-0.7 V**
- **h_{FE} ... 40-250 @ V_{CE} = 4.0 V, I_C = 0.5 A**
- **Complements ... 2N5320, NPN (2N5322, PNP); 2N5321, NPN (2N5322, PNP)**

PACKAGE

2N5320	TO-39
2N5321	TO-39
2N5322	TO-39
2N5323	TO-39

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-65° C to 200° C
Operating Junction Temperature	200° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at 25° C Case Temperature	10 W
Linear Derating Factor	0.057W/° C

Voltages & Currents		**5320**	**5321**
V_{CEO}	Collector to Emitter Voltage	75 V	50 V
V_{CBO}	Collector to Base Voltage	100 V	75 V
V_{EBO}	Emitter to Base Voltage	7.0 V	5.0 V
I_C	Collector Current	2.0 A	2.0 A
I_B	Base Current	1.0 A	1.0 A

Voltages & Currents		**5322**	**5322**
V_{CEO}	Collector to Emitter Voltage	−75 V	−50 V
V_{CBO}	Collector to Base Voltage	−100 V	−75 V
V_{EBO}	Emitter to Base Voltage	−7.0 V	−5.0 V
I_C	Collector Current	2.0 A	2.0 A
I_B	Base Current	1.0 A	1.0 A

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	5320 MIN	5320 MAX	5321 MIN	5321 MAX	UNITS	TEST CONDITIONS
I_{EBO}	Emitter Cutoff Current		0.1			mA	V_{EB} = 7.0 V
					0.1	mA	V_{EB} = 5.0 V

NOTES:
1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. Pulse conditions: length = 300 μs; duty cycle ≤ 10%.
3. Pulse Rep. Frequency = 1 kHz, pulse width = 20 μs.
4. These ratings give a maximum junction temperature of 200° C and junction-to-case thermal resistance of 0.2° C/W (derating factor of 0.057 W/° C.
5. Emitter diode is reversed biased.
6. For product family characteristic curves, refer to Curve Set T314 (2N5320 and 2N5321) and Curve Set T414 (2N5322 and 2N5323).

SYMBOL	CHARACTERISTIC	5320 MIN	5320 MAX	5321 MIN	5321 MAX	UNITS	TEST CONDITIONS
I_{CEX}	Collector Cutoff Current (Note 3)		5.0			mA	$V_{CE} = 70$ V, $V_{BE} = 1.5$ V, $T_C = 150°C$
					5.0	mA	$V_{CE} = 45$ V, $V_{BE} = 1.5$ V, $T_C = 150°C$
			0.1			mA	$V_{CE} = 100$ V, $V_{BE} = 1.5$ V
					0.1	mA	$V_{CE} = 75$ V, $V_{BE} = 1.5$ V
h_{FE}	DC Current Gain (Note 2)	10					$I_C = 1.0$ A, $V_{CE} = 2.0$ V
		30	130	40	250		$I_C = 0.5$ A, $V_{CE} = 4.0$ V
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Note 2)	75		50		V	$I_C = 100$ mA, $I_B = 0$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 2)		0.5		0.8	V	$I_C = 500$ mA, $I_B = 50$ mA
$V_{BE(ON)}$	Base to Emitter "On" Voltage (Note 2)		1.1		1.4	V	$I_C = 500$ mA, $V_{CE} = 4.0$ V
h_{fe}	Small Signal Current Gain	5.0		5.0			$I_C = 50$ mA, $V_{CE} = 4.0$ V, f = 10 MHz
t_{on}	Turn On Time (Note 3)		80		80	ns	$I_C = 500$ mA, $I_{B1} = 50$ mA
t_{off}	Turn Off Time (Note 3)		800		800	ns	$I_C = 500$ mA, $I_{B1} = 50$ mA, $I_{B2} = -50$ mA

SYMBOL	CHARACTERISTIC	5322 MIN	5322 MAX	5323 MIN	5323 MAX	UNITS	TEST CONDITIONS
I_{EBO}	Emitter Cutoff Current		0.1			mA	$V_{EB} = -7.0$ V
					0.1	mA	$V_{EB} = -5.0$ V
I_{CEX}	Collector Cutoff Current		5.0			mA	$V_{CE} = -70$ V, $V_{BE} = -1.5$ V, $T_C = 150°C$
					5.0	mA	$V_{CE} = -45$ V, $V_{BE} = -1.5$ V, $T_C = 150°C$
			0.1			mA	$V_{CE} = -100$ V, $V_{BE} = -1.5$ V
					0.1	mA	$V_{CE} = -75$ V, $V_{BE} = -1.5$ V
h_{FE}	DC Current Gain	10					$I_C = 1.0$ A, $V_{CE} = -2.0$ V
		30	130	40	250		$I_C = 500$ mA, $V_{CE} = -4.0$ V
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Note 2)	−75		−50		V	$I_C = -100$ mA, $I_B = 0$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 2)		−0.7		−1.20	V	$I_C = 50$ mA, $I_B = 50$ mA
$V_{BE(ON)}$	Base to Emitter "On" Voltage (Note 2)		−1.1		−1.4	V	$I_C = 500$ mA, $V_{CE} = -4.0$ V
h_{fe}	Small Signal Current Gain	5.0		5.0			$I_C = 50$ mA, $V_{CE} = 4.0$ V, f = 10 MHz
t_{on}	Turn On Time (Note 3)		100		100	ns	$I_C = 500$ mA, $I_{B1} = -50$ mA
t_{off}	Turn Off Time (Note 3)		1000		1000	ns	$I_C = 500$ mA, $I_{B1} = -50$ mA, $I_{B2} = 50$ mA

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2N5336/2N5338

6 Watt NPN Silicon Power

- **P_D ... 6.0 W @ T_C = 25° C**
- **LV_{CEO} ... 80 V and 100 V (Min)**
- **$V_{CE(sat)}$ ... 1.2 V (Max) @ 5.0 A**

PACKAGE

2N5336	TO-5
2N5338	TO-5

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-65° C to 200° C
Operating Junction Temperature	200° C

Power Dissipation

Total Dissipation at 25° C Case Temperature	6.0 W

Voltages & Currents

		5336	5338
V_{CEO}	Collector to Emitter Voltage	80 V	100 V
V_{CBO}	Collector to Base Voltage	80 V	100 V
V_{EBO}	Emitter to Base Voltage	6.0 V	6.0 V
I_C	Collector Current	5.0 A	5.0 A
I_B	Base Current	1.0 A	1.0 A

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 4)

SYMBOL	CHARACTERISTIC	5336 MIN	5336 MAX	5338 MIN	5338 MAX	UNITS	TEST CONDITIONS
I_{EBO}	Emitter Cutoff Current		100		100	μA	V_{EB} = 6.0 V, I_C = 0
I_{CBO}	Collector Cutoff Current		10			μA	V_{CE} = 80 V, I_E = 0
					10	μA	V_{CE} = 100 V, I_E = 0
I_{CEX}	Collector Cutoff Current		10			μA	V_{CE} = 75 V, V_{BE} = 1.5 V
			1.0			mA	V_{CE} = 75 V, V_{EB} = 1.5 V, T_C = 150°C
					10	μA	V_{CE} = 90 V, V_{BE} = 1.5 V
					1.0	mA	V_{CE} = 90 V, V_{BE} = 1.5 V, T_C = 150° C
h_{FE}	DC Current Gain (Note 2)	30		30			I_C = 500 mA, V_{CE} = 2.0 V
		30	120	30	120		I_C = 2.0 A, V_{CE} = 2.0 V
		20		20			I_C = 5.0 A, V_{CE} = 2.0 V

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. Pulse conditions: length = 300 μs; duty cycle μ 2%.
3. These ratings give a maximum junction temperature of 200()C and junction-to-case thermal resistance of 33.3()C/W (linear derating factor of 34 mW/()C.
4. For product family characteristic curves, refer to Curve Set T316.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted). (Note 6)

SYMBOL	CHARACTERISTIC	5336 MIN	5336 MAX	5338 MIN	5338 MAX	UNITS	TEST CONDITIONS
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Note 2)	80		100		V	$I_C = 50$ mA, $I_B = 0$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Pulsed) (Note 2)		0.7 1.2		0.7 1.2	V V	$I_C = 2.0$ A, $I_B = 200$ mA $I_C = 5.0$ A, $I_B = 500$ mA
$V_{BE(sat)}$	Base Saturation Voltage (Pulsed) (Note 2)		1.2 1.8		1.2 1.8	V V	$I_C = 2.0$ A, $I_B = 200$ mA $I_C = 5.0$ A, $I_B = 500$ mA
t_d	Turn On Delay Time		100		100	ns	$I_C = 2.0$ A, $V_{CC} = 4.0$ V, $I_{B1} = 200$ mA
t_r	Turn On Rise Time		100		100	ns	$I_C = 2.0$ A, $V_{CC} = 40$ V, $I_{B1} = 200$ mA
t_s	Turn Off Storage Time		2.0		2.0	μs	$I_C = 2.0$ A, $V_{CC} = 40$ V, $I_{B1} = I_{B2} = 200$ mA
t_f	Turn Off Fall Time		200		200	ns	$I_C = 2.0$ A, $V_{CC} = 40$ V, $I_{B1} = I_{B2} = 200$ mA

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2N5400/FTSO5400
2N5401/FTSO5401

PNP High Voltage Small Signal General Purpose Amplifiers

- V_{CEO} ... **−120 V (Min) (2N/FTSO5400), −150 V (Min) (2N/FTSO5401)**
- h_{FE} ... **60-240 @ 10 mA (2N/FTSO5401)**
- $V_{CE(sat)}$ ... **−0.5 V (Max) @ 50 mA**
- **Complements** ... **2N5550, MPS5551M**

PACKAGE

2N5400	TO-92
2N5401	TO-92
FTSO5400	TO-236AA/AB
FTSO5401	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	−55° to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	2N	FTSO
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents

		5400	5401
V_{CEO}	Collector to Emitter Voltage (Note 4)	−120 V	−150 V
V_{CBO}	Collector to Base Voltage	−130 V	−150 V
V_{EBO}	Emitter to Base Voltage	−5.0 V	−5.0 V
I_C	Collector Current	600 mA	600 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	5400 MIN	5400 MAX	5401 MIN	5401 MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage (Note 5)	−120		−150		V	$I_C = 1.0$ mA, $I_B = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	−130		−160		V	$I_C = 100$ μA, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	−5.0		−5.0		V	$I_E = 10$ μA, $I_C = 0$
I_{EBO}	Emitter Cutoff Current		50		50	nA	$V_{EB} = -3.0$ V, $I_C = 0$
I_{CBO}	Collector Cutoff Current		100			nA	$V_{CB} = -100$ V, $I_E = 0$
					50	nA	$V_{CB} = -120$ V, $I_E = 0$
			100			μA	$V_{CB} = -100$ V, $I_E = 0$, $T_A = 100°$ C
					50	μA	$V_{CB} = -120$ V, $I_E = 0$, $T_A = 100°$ C
h_{FE}	DC Pulse Current Gain (Note 5)	30		50			$I_C = 1.0$ mA, $V_{CE} = -5.0$ V
		40	180	60	240		$I_C = 10$ mA, $V_{CE} = -5.0$ V
		40		50			$I_C = 50$ mA, $V_{CE} = -5.0$ V

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 2%.
6. For product family characteristic curves, refer to Curve Set T232.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

3

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	5400 MIN	5400 MAX	5401 MIN	5401 MAX	UNITS	TEST CONDITIONS
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		–0.20 –0.5		–0.20 –0.5	V V	$I_C = 10$ mA, $I_B = 1.0$ mA $I_C = 50$ mA, $I_B = 5.0$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)		–1.0 –1.0		–1.0 –1.0	V V	$I_C = 10$ mA, $I_B = 1.0$ mA $I_C = 50$ mA, $I_B = 5.0$ mA
C_{ob}	Output Capacitance		6.0		6.0	pF	$V_{CB} = -10$ V, $I_E = 0$, f = 1.0 MHz
h_{fe}	Small Signal Current Gain	30	200	40	200		$I_C = 1.0$ mA, $V_{CE} = -10$ V, f = 1.0 kHz
f_T	Current Gain Bandwidth Product	100	400	100	300	mHz	$I_C = 10$ mA, $V_{CE} = -10$ V, f = 100 MHz
NF	Noise Figure		8.0		8.0	dB	$I_C = 250\ \mu A$, $V_{CE} = -5.0$ V, f = 10 Hz to 15.7 kHz, $R_S = 1.0\ k\Omega$

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2N5415/2N5416

PNP Silicon Power Transistor

- **10 W Dissipation at 25° C Case**
- **1 A (Max) Continuous Collector Current**
- **Up to 350 V V_{CBO} Rating (2N5416)**
- **Complements . . . 2N3439, 2N3440**

PACKAGE

2N5415	TO-39
2N5416	TO-39

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-65° C to 200° C
Operating Junction Temperature	200° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at 25° C Case Temperature	10 W

Voltages & Currents (Note 4)		**5415**	**5416**
V_{CEO}	Collector to Emitter Voltage	−200 V	−300 V
V_{CBO}	Collector to Base Voltage	−200 V	−350 V
V_{EBO}	Emitter to Base Voltage	−4.0 V	−4.0 V
I_C	Collector Current (Continuous)	1.0 A	1.0 A
I_B	Base Current (Continuous)	0.5 A	0.5 A

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	5415 MIN	5415 MAX	5416 MIN	5416 MAX	UNITS	TEST CONDITIONS
I_{EBO}	Emitter Cutoff Current		20			μA	$V_{EB} = -4.0$ V, $I_C = 0$
					20	μA	$V_{EB} = -6.0$ V, $I_C = 0$
I_{CBO}	Collector Cutoff Current		50			μA	$V_{CB} = -175$ V, $I_E = 0$
					50	μA	$V_{CB} = -280$ V, $I_E = 0$
I_{CEV}	Collector Cutoff Current		50			μA	$V_{CE} = -200$ V, $V_{BE} = 1.5$ V
					50	μA	$V_{CE} = -300$ V, $V_{BE} = 1.5$ V
I_{CEO}	Collector Cutoff Current		50			μA	$V_{CE} = -150$ V, $I_B = 0$
					50	μA	$V_{CE} = -250$ V, $I_B = 0$
h_{FE}	DC Current Gain (Note 5)	30	150	30	120		$I_C = 50$ mA, $V_{CE} = -10$ V

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 200° C and junction-to-case thermal resistance of 0.2° C/W (derating factor of 0.057 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 2%.
6. For product family characteristic curves, refer to Curve Set T443.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	5415 MIN	5415 MAX	5416 MIN	5416 MAX	UNITS	TEST CONDITIONS
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Note 5)	−200		−300		V	$I_C = 50$ mA, $I_B = 0$
$V_{CER(sus)}$	Collector to Emitter Sustaining Voltage (Note 5)			−350		V	$I_C = 50$ mA, $R_{BE} = 50\ \Omega$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		−2.5		−2.0	V	$I_C = 50$ mA, $I_B = 5.0$ mA
$V_{BE(ON)}$	Base to Emitter "On" Voltage		−1.5		−1.5	V	$I_C = 50$ mA, $V_{CE} = -10$ V
C_{ob}	Output Capacitance		15		15	pF	$V_{CB} = -10$ V, $I_E = 0$ f = 1.0 MHz
C_{ib}	Input Capacitance		75		75	pF	$V_{EB} = -5.0$ V, $I_C = 0$ f = 1.0 MHz
$\lvert h_{fe} \rvert$	Magnitude of Common Emitter Small Signal Current Gain	3.0		3.0			$I_C = 10$ mA, $V_{CE} = -10$ V, f = 5.0 MHz
h_{fe}	Small Signal Current Gain	25		25			$I_C = 5.0$ mA, $V_{CE} = -10$ V, f = 1.0 kHz
$R_e(h_{ie})$	Real Part of Common Emitter Small Signal Short-Circuit Impedance		300		300	Ω	$I_C = 5.0$ mA, $V_{CE} = -10$ V, f = 1.0 MHz
$I_{s/b}$	Second Breakdown Collector Current	100		100		mA	$V_{CE} = -100$ V, t = 1.0 s (non repetitive)

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2N5550/FTSO5550
2N5551/MPS5551
FTSO5551

NPN Small Signal High Voltage General Purpose Amplifiers

- **V_{CEO} ... 160 V (Min) (MPS/FTSO5551)**
- **h_{FE} ... 80-250 @ 10 mA (MPS/FTSO5551)**
- **$V_{CE(sat)}$ ... 0.2 V (max) @ 50 mA (MPS/FTSO5551)**
- **Complements ... 2N5400, 2N5401**

PACKAGE

2N5550	TO-92
2N5551	TO-92
MPS5551	TO-92
FTSO5550	TO-236AA/AB
FTSO5551	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	−55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	2N	FTSO
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents

		5550	5551
V_{CEO}	Collector to Emitter Voltage (Note 4)	140 V	160 V
V_{CBO}	Collector to Base Voltage	160 V	180 V
V_{EBO}	Emitter to Base Voltage	6.0 V	6.0 V
I_C	Collector Current	600 mA	600 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	5550 MIN	5550 MAX	5551 MIN	5551 MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage	140		160		V	$I_C = 1.0$ mA, $I_B = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	160		180		V	$I_C = 100\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	6.0		6.0		V	$I_E = 10\ \mu A$, $I_C = 0$
I_{EBO}	Emitter Cutoff Current		50		50	nA	$V_{EB} = 4.0$ V, $I_C = 0$
I_{CBO}	Collector Cutoff Current		100			nA	$V_{CB} = 100$ V, $I_E = 0$
					50	nA	$V_{CB} = 120$ V, $I_E = 0$
			100			μA	$V_{CB} = 100$ V, $I_E = 0$, $T_A = 100°$ C
					50	μA	$V_{CB} = 120$ V, $I_E = 0$, $T_A = 100°$ C

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T147.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	5550 MIN	5550 MAX	5551 MIN	5551 MAX	UNITS	TEST CONDITIONS
h_{FE}	DC Pulse Current Gain (Note 5)	60 60 20	 250	80 80 30	 250		$I_C = 1.0$ mA, $V_{CE} = 5.0$ V $I_C = 10$ mA, $V_{CE} = 5.0$ V $I_C = 50$ mA, $V_{CE} = 5.0$ V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.15 0.25		0.15 0.25	V V	$I_C = 10$ mA, $I_B = 1.0$ mA $I_C = 50$ mA, $I_B = 5.0$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)		1.0 1.2		1.0 1.0	V V	$I_C = 10$ mA, $I_B = 1.0$ mA $I_C = 50$ mA, $I_B = 5.0$ mA
C_{ob}	Output Capacitance		6.0		6.0	pF	$V_{CB} = 10$ V, $I_E = 0$, $f = 1.0$ MHz
C_{ib}	Input Capacitance (2N/FTSO5550) (MPS/FTSO5551) (2N5551)		 30		 30 20	 pF pF pF	 $V_{BE} = 0.5$ V, $I_C = 0$, $f = 1.0$ MHz $V_{BE} = 0.5$ V, $I_C = 0$, $f = 1.0$ MHz $V_{BE} = 0.5$ V, $I_C = 0$, $f = 1.0$ MHz
h_{fe}	Small Signal Current Gain	50	200	50	200		$I_C = 1.0$ mA, $V_{CE} = -10$ V, $f = 1.0$ kHz
f_T	Current Gain Bandwidth Product	100	300	100	300	MHz	$I_C = 10$ mA, $V_{CE} = 10$ V, $f = 100$ MHz
NF	Noise Figure		10		8.0	dB	$I_C = 250$ μA, $V_{CE} = 5.0$ V, $f = 10$ Hz to 15.7 kHz, $R_S = 1.0$ kΩ

FAIRCHILD

A Schlumberger Company

2N5679/2N5680
2N5681/2N5682

1.0 Amp 10 Watt NPN-PNP Complementary Power

- **f_T ... 30 MHz @ I_C = 100 mA**
- **$V_{CE(sat)}$ ... 0.6 V @ I_C = 0.25 A**
- **Complements ... 2N5679, PNP (2N5681, NPN); 2N5680, PNP (2N5682, NPN)**

PACKAGE:

2N5679	TO-39
2N5680	TO-39
2N5681	TO-39
2N5682	TO-39

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-65° C to 200° C
Operating Junction Temperature	200° C

Power Dissipation (Notes 2 & 3)

Continuous Dissipation at 25° C Ambient Temperature	1.0 W
Continuous Dissipation at 25° C Case Temperature	10 W

Voltages & Currents (Note 4)		**5679**	**5680**
V_{CEO}	Collector to Emitter Voltage	−100 V	−120 V
V_{CBO}	Collector to Base Voltage	−100 V	−120 V
V_{EBO}	Emitter to Base Voltage	−4.0 V	−4.0 V
I_C	Collector Current	1.0 A	1.0 A
I_B	Base Current	0.5 A	0.5 A

Voltages & Currents (Note 4)		**5681**	**5682**
V_{CEO}	Collector to Emitter Voltage	100 V	120 V
V_{CBO}	Collector to Base Voltage	100 V	120 V
V_{EBO}	Emitter to Base Voltage	4.0 V	4.0 V
I_C	Collector Current	1.0 A	1.0 A
I_B	Base Current	0.5 A	0.5 A

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	5679 MIN	5679 MAX	5680 MIN	5680 MAX	UNITS	TEST CONDITIONS
I_{EBO}	Emitter Cutoff Current		1.0		1.0	μA	$V_{EB} = -4.0$ V, $I_C = 0$
I_{CBO}	Collector Cutoff Current		1.0			μA	$V_{CB} = -100$ V, $I_E = 0$
					1.0	μA	$V_{CB} = -120$ V, $I_E = 0$

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 200° C and junction-to-case thermal resistance of 0.2° C/W (derating factor of 0.057 mW/° C); junction-to-ambient thermal resistance of 0.02° C/W (derating factor of 0.0057 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 2%.
6. For product family characteristic curves, refer to Curve Set T415 (2N5679 and 2N5680) and Curve Set T315 (2N5681 and 2N5782).

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	5679 MIN	5679 MAX	5680 MIN	5680 MAX	UNITS	TEST CONDITIONS
I_{CEO}	Collector Cutoff Current		10			μA	$V_{CB} = -70$ V, $I_B = 0$
					10	μA	$V_{CB} = -80$ V, $I_B = 0$
I_{CEX}	Collector Reverse Current (Note 3)		1.0			mA	$V_{CE} = -100$ V, $V_{BE} = -1.5$ V, $T_C = 150°C$
					1.0	mA	$V_{CE} = -120$ V, $V_{BE} = -1.5$ V, $T_C = 150°C$
			1.0			μA	$V_{CE} = -100$ V, $V_{BE} = -1.5$ V
					1.0	μA	$V_{CE} = -120$ V, $V_{BE} = -1.5$ V
h_{FE}	DC Current Gain (Note 5)	5.0		5.0			$I_C = 1.0$ A, $V_{CE} = -2.0$ V
		40	150	40	150		$I_C = 250$ mA, $V_{CE} = -2.0$ V
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Note 5)	−100		−120		V	$I_C = 10$ mA, $I_B = 0$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		−2.0		−2.0	V	$I_C = 1.0$ mA, $I_B = 200$ mA
			−1.0		−1.0	V	$I_C = 500$ mA, $I_B = 50$ mA
			−0.6		−0.6	V	$I_C = 250$ mA, $I_B = 25$ mA
$V_{BE(ON)}$	Base to Emitter "On" Voltage (Note 5)		−1.0		−1.0	V	$I_C = 250$ mA, $V_{CE} = -2.0$ V
C_{ob}	Common Base Output Capacitance		50		50	pF	$V_{CB} = -20$ mA, $I_E = 0$, f = 1.0 MHz
h_{fe}	High Frequency Current Gain	3.0		3.0			$I_C = 100$ mA, $V_{CE} = -10$ V, f = 10 MHz
h_{fe}	Small Signal Current Gain	40		40			$I_C = 200$ mA, $V_{CE} = -1.5$ V, f = 1.0 kHz

SYMBOL	CHARACTERISTIC	5681 MIN	5681 MAX	5682 MIN	5682 MAX	UNITS	TEST CONDITIONS
I_{EBO}	Emitter Cutoff Current		1.0		1.0	μA	$V_{EB} = 4.0$ V, $I_C = 0$
I_{CBO}	Collector Cutoff Current		1.0			μA	$V_{CB} = 100$ V, $I_E = 0$
					1.0	μA	$V_{CB} = 120$ V, $I_E = 0$
I_{CEO}	Collector Cutoff Current		10			μA	$V_{CB} = 70$ V, $I_B = 0$
					10	μA	$V_{CB} = 80$ V, $I_B = 0$
I_{CEX}	Collector Cutoff Current		1.0			mA	$V_{CE} = 100$ V, $V_{BE} = 1.5$ V, $T_C = 150°C$
					1.0	mA	$V_{CE} = 120$ V, $V_{BE} = -1.5$ V, $T_C = 150°C$
			1.0			μA	$V_{CE} = -100$ V, $V_{BE} = 1.5$ V
					1.0	μA	$V_{CE} = -120$ V, $V_{BE} = 1.5$ V
h_{FE}	DC Current Gain (Note 5)	5.0		5.0			$I_C = 1.0$ A, $V_{CE} = 2.0$ V
		40	150	40	150		$I_C = 250$ mA, $V_{CE} = 2.0$ V
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Note 5)	100		120		V	$I_C = 10$ mA, $I_B = 0$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		2.0		2.0	V	$I_C = 1.0$ mA, $I_B = 200$ mA
			1.0		1.0	V	$I_C = 500$ mA, $I_B = 50$ mA
			0.6		0.6	V	$I_C = 250$ mA, $I_B = 25$ mA
$V_{BE(ON)}$	Base to Emitter "On" Voltage (Note 2)		1.0		1.0	V	$I_C = 250$ mA, $V_{CE} = 2.0$ V
C_{ob}	Output Capacitance		50		50	pF	$V_{CB} = 20$ mA, $I_E = 0$, f = 1.0 MHz
h_{fe}	High Frequency Current Gain	3.0		3.0			$I_C = 100$ mA, $V_{CE} = 10$ V, f = 10 MHz
h_{fe}	Small Signal Current Gain	40		40			$I_C = 200$ mA, $V_{CE} = 1.5$ V, f = 1.0 kHz

FAIRCHILD

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2N5771/FTSO5771

PNP Ultra High Speed Saturated Logic Switch

- V_{CEO} ... **15 V (Min)**
- t_{on} ... **15 ns (Max) @ 10 mA, t_{off} ... 20 ns (Max) @ 10 mA**
- τ_s ... **20 ns (Max) @ 10 mA**
- **Complements ... 2N5769, 2N5772**

PACKAGE

2N5771	TO-92
FTSO5771	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	**2N**	**FTSO**
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents

V_{CEO}	Collector to Emitter Voltage (Note 4)	−15 V
V_{CBO}	Collector to Base Voltage	−15 V
V_{EBO}	Emitter to Base Voltage	−4.5 V
I_C	Collector Current	50 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage (Note 5)	−15		V	$I_C = 3.0$ mA, $I_B = 0$
BV_{CES}	Collector to Emitter Breakdown Voltage	−15		V	$I_C = 100$ μA, $V_{BE} = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	−15		V	$I_C = 100$ μA, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	−4.5		V	$I_E = 100$ μA, $I_C = 0$
I_{CBO}	Collector to Base Cutoff Current		10	nA	$V_{CB} = -8.0$ V, $I_C = 0$
I_{EBO}	Emitter Cutoff Current		1.0	μA	$V_{EB} = -4.5$ V, $I_C = 0$
I_{CES}	Collector Reverse Current		10 5.0	nA μA	$V_{CE} = -8.0$ V, $V_{BE} = 0$ $V_{CE} = -8.0$ V, $V_{BE} = 0$, $T_A = 125°C$
h_{FE}	DC Current Gain (Note 5)	35 50 40 20	 120 		$I_C = 1.0$ mA, $V_{CE} = -0.5$ V $I_C = 10$ mA, $V_{CE} = -0.3$ V $I_C = 50$ mA, $V_{CE} = -1.0$ V $I_C = 10$ mA, $V_{CE} = -0.3$ V, $T_A = 55°C$

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T292.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	MIN	MAX	UNITS	TEST CONDITIONS
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		−0.18 −0.15 −0.6	V V V	$I_C = 10$ mA, $I_B = 1.0$ mA $I_C = 1.0$ mA, $I_B = 0.1$ mA $I_C = 50$ mA, $I_B = 5.0$ mA
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 5)	 −0.8 	−0.8 −0.95 −1.5	V V V	$I_C = 1.0$ mA, $I_B = 0.1$ mA $I_C = 10$ mA, $I_B = 1.0$ mA $I_C = 50$ mA, $I_B = 5.0$ mA
C_{cb}	Collector to Base Capacitance		3.0	pF	$V_{CB} = -5.0$ V, $I_E = 0$, f = 140 kHz
C_{eb}	Emitter to Base Capacitance		3.5	pF	$V_{EB} = -0.5$ V, $I_C = 0$, f = 140 kHz
h_{fe}	High Frequency Current Gain	8.5			$I_C = 10$ mA, $V_{CE} = -10$ V, f = 100 MHz
t_{on}	Turn On Time (test circuit no 348)		15	ns	$I_C = 10$ mA, $I_{B1} = 1.0$ mA
t_{off}	Turn Off Time (test circuit no 348)		20	ns	$I_C = 10$ mA, $I_{B1} = I_{B2} = 1.0$ mA
τ_s	Charge Storage Time Constant (test circuit no. 234)		20	ns	$I_C = 10$ mA, $I_{B1} \simeq I_{B2} \simeq 10$ mA

FAIRCHILD

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2N5830/FTSO5830
2N5831/FTSO5831
2N5833/FTSO5833

NPN Small Signal High Voltage General Purpose Amplifiers

- **V_{CEO} ... 100 V (Min) (2N5830), 140 V (Min) (2N/FTSO5831), 180 V (Min) (2N/FTSO5833)**
- **h_{FE} ... 80 (Min) (2N/FTSO5830/1), 50 (Min) (2N/FTSO5833)**
- **C_{cb} ... 4.0 pF (Max)**

PACKAGE

2N5830	TO-92
2N5831	TO-92
2N5833	TO-92
FTSO5830	TO-236AA/AB
FTSO5831	TO-236AA/AB
FTSO5833	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	−55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	2N	FTSO
25° C Ambient Temperature	0.625 W	0.350 W*
25° C Case Temperature	1.0 W	

Voltages & Currents		**5830**	**5831**	**5833**
V_{CEO}	Collector to Emitter Voltage (Note 4)	100 V	140 V	180 V
V_{CBO}	Collector to Base Voltage	120 V	160 V	200 V
V_{EBO}	Emitter to Base Voltage	5.0 V	5.0 V	6.0 V
I_C	Collector Current	600 mA	600 mA	600 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 5)

SYMBOL	CHARACTERISTIC	5830 MIN	5830 MAX	5831 MIN	5831 MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage	100		140		V	$I_C = 1.0$ mA, $I_B = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	120		160		V	$I_C = 100\ \mu$A, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0		5.0		V	$I_E = 10\ \mu$A, $I_C = 0$
I_{EBO}	Emitter Cutoff Current		50		50	nA	$V_{EB} = 4.0$ V, $I_C = 0$
I_{CBO}	Collector Cutoff Current		50			nA	$V_{CB} = 100$ V, $I_E = 0$
					50	nA	$V_{CB} = 120$ V, $I_E = 0$
			25			μA	$V_{CB} = 100$ V, $I_E = 0$, $T_A = 100°$ C
					25	μA	$V_{CB} = 120$ V, $I_E = 0$, $T_A = 100°$ C
h_{FE}	DC Current Gain (Note 4)	60		60			$I_C = 1.0$ mA, $V_{CE} = 5.0$ V
		80	500	80	250		$I_C = 10$ mA, $V_{CE} = 5.0$ V
		80		80			$I_C = 50$ mA, $V_{CE} = 5.0$ V

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Pulse conditions: length ≤ 300 μs; duty cycle ≤ 1%.
5. For product family characteristic curves, refer to Curve Set T147.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 5)

SYMBOL	CHARACTERISTIC	5830 MIN	5830 MAX	5831 MIN	5831 MAX	UNITS	TEST CONDITIONS
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 4)		0.15 0.20 0.25		0.15 0.20 0.25	V V V	$I_C = 1.0$ mA, $I_B = 0.1$ mA $I_C = 10$ mA, $I_B = 1.0$ mA $I_C = 50$ mA, $I_B = 5.0$ mA
$V_{BE(ON)}$	Base to Emitter "On" Voltage		0.8		0.8	V	$I_C = 1.0$ mA, $V_{CE} = 5.0$ V
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 4)		0.8 1.0 1.0		0.8 1.0 1.0	V V V	$I_C = 1.0$ mA, $I_B = 0.1$ mA $I_C = 10$ mA, $I_B = 1.0$ mA $I_C = 50$ mA, $I_B = 5.0$ mA
C_{cb}	Collector to Base Capacitance		4.0		4.0	pF	$V_{CB} = 10$ V, $I_E = 0$, f = 1.0 MHz
$\|h_{fe}\|$	Magnitude of Common Emitter High Frequency Current Gain	1.0	5.0	1.0	5.0		$I_C = 10$ mA, $V_{CE} = 10$ V, f = 100 MHz
h_{fe}	Small Signal Current Gain	60		60			$I_C = 1.0$ mA, $V_{CE} = 10$ V, f = 1.0 kHz
h_{ie}	Input Resistance		6.0		6.0	kΩ	$I_C = 1.0$ mA, $V_{CE} = 10$ V, f = 1.0 kHz
h_{oe}	Output Conductance		40		40	μmho	$I_C = 1.0$ mA, $V_{CE} = 10$ V, f = 1.0 kHz

3

SYMBOL	CHARACTERISTIC	5833 MIN	5833 MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage	180		V	$I_C = 1.0$ mA, $I_B = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	200		V	$I_C = 100\ \mu A$, $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	6.0		V	$I_E = 10\ \mu A$, $I_C = 0$
I_{EBO}	Emitter Cutoff Current		50	nA	$V_{EB} = 5.0$ V, $I_C = 0$
I_{CBO}	Collector Cutoff Current		10 25	nA μA	$V_{CB} = 160$ V, $I_E = 0$ $V_{CB} = 160$ V, $I_E = 0$, $T_A = 100°$ C
h_{FE}	DC Current Gain (Note 4)	50 50 50	 250 		$I_C = 1.0$ mA, $V_{CE} = 5.0$ V $I_C = 10$ mA, $V_{CE} = 5.0$ V $I_C = 50$ mA, $V_{CE} = 5.0$ V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 4)		0.15 0.20 0.25	V V V	$I_C = 1.0$ mA, $I_B = 0.1$ mA $I_C = 10$ mA, $I_B = 1.0$ mA $I_C = 50$ mA, $I_B = 5.0$ mA
$V_{BE(ON)}$	Base to Emitter "On" Voltage		0.8	V	$I_C = 1.0$ mA, $V_{CE} = 5.0$ V
$V_{BE(sat)}$	Base to Emitter Saturation Voltage (Note 4)		0.8 1.0 1.0	V V V	$I_C = 1.0$ mA, $I_B = 0.1$ mA $I_C = 10$ mA, $I_B = 1.0$ mA $I_C = 50$ mA, $I_B = 5.0$ mA
C_{cb}	Collector to Base Capacitance		4.0	pF	$V_{CB} = 10$ V, $I_E = 0$, f = 1.0 MHz
$\|h_{fe}\|$	Magnitude of Common Emitter High Frequency Current Gain	1.0	5.0		$I_C = 10$ mA, $V_{CE} = 10$ V, f = 100 MHz
h_{fe}	Small Signal Current Gain	50			$I_C = 1.0$ mA, $V_{CE} = 10$ V, f = 1.0 kHz
h_{ie}	Input Resistance		6.0	kΩ	$I_C = 1.0$ mA, $V_{CE} = 10$ V, f = 1.0 kHz
h_{oe}	Output Conductance		40	μmho	$I_C = 1.0$ mA, $V_{CE} = 10$ V, f = 1.0 kHz

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2N5961/FTSO5961
2N5962/FTSO5962

NPN Low Level Low Noise Amplifiers

- I_{CBO} . . . 2.0 nA (Max) @ V_{CB} = 45 V, 50 nA (Max) @ V_{CB} = 45 V, T_A = 65° C (2N/FTSO5961)
- $V_{CE(sat)}$ . . . 0.2 V (Max) @ 10 mA/0.5 mA
- h_{FE} . . . 900 (Min) @ 10 μA

PACKAGE

2N5961	TO-92
2N5962	TO-92
FTSO5961	TO-236AA/AB
FTSO5962	TO-236AA/AB

ABSOLUTE MAXIMUM RATINGS (Note 1)

Temperatures

Storage Temperature	-55° C to 150° C
Operating Junction Temperature	150° C

Power Dissipation (Notes 2 & 3)

Total Dissipation at	2N	FTSO
25° C Ambient Temperature	0.625 W	0.350 W*
70° C Ambient Temperature	0.400 W	
25° C Case Temperature	1.0 W	

Voltages & Currents

		5961	5962
V_{CEO}	Collector to Emitter Voltage (Note 4)	60 V	45 V
V_{CBO}	Collector to Base Voltage	60 V	45 V
V_{EBO}	Emitter to Base Voltage	8.0 V	8.0 V
I_C	Collector Current (Continuous)	50 mA	50 mA

ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	5961 MIN	5961 MAX	5962 MIN	5962 MAX	UNITS	TEST CONDITIONS
BV_{CEO}	Collector to Emitter Breakdown Voltage	60		45		V	I_C = 5.0 mA, I_B = 0
BV_{CBO}	Collector to Base Breakdown Voltage	60		45		V	I_C = 10 μA, I_E = 0
BV_{EBO}	Emitter to Base Breakdown Voltage	8.0		8.0		V	I_E = 10 μA, I_C = 0
I_{EBO}	Emitter Cutoff Current		1.0		1.0	nA	V_{EB} = 5.0 V, I_C = 0
I_{CBO}	Collector Cutoff Current		2.0			nA	V_{CB} = 45 V, I_E = 0
					2.0	nA	V_{CB} = 30 V, I_E = 0
			50			nA	V_{CB} = 45 V, I_E = 0, T_A = 65° C
					50	nA	V_{CB} = 30 V, I_E = 0, T_A = 65° C

NOTES:

1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
3. These ratings give a maximum junction temperature of 150° C and (TO-92) junction-to-case thermal resistance of 125° C/W (derating factor of 8.0 mW/° C); junction-to-ambient thermal resistance of 200° C/W (derating factor of 5.0 mW/° C); (TO-236) junction-to-ambient thermal resistance of 357° C/W (derating factor of 2.8 mW/° C).
4. Rating refers to a high current point where collector to emitter voltage is lowest.
5. Pulse conditions: length = 300 μs; duty cycle = 1%.
6. For product family characteristic curves, refer to Curve Set T107.

* Package mounted on 99.5% alumina 8 mm x 8 mm x 0.6 mm.

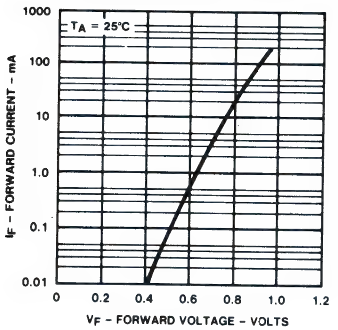
ELECTRICAL CHARACTERISTICS (25° C Ambient Temperature unless otherwise noted) (Note 6)

SYMBOL	CHARACTERISTIC	5961 MIN	5961 MAX	5962 MIN	5962 MAX	UNITS	TEST CONDITIONS
h_{FE}	DC Current Gain	100 120 135		450 500 550			$I_C = 10\ \mu A$, $V_{CE} = 5.0\ V$ $I_C = 100\ \mu A$, $V_{CE} = 5.0\ V$ $I_C = 1.0\ mA$, $V_{CE} = 5.0\ V$
h_{FE}	DC Pulse Current Gain (Note 5)	150	700	600	1400		$I_C = 10\ mA$, $V_{CE} = 5.0\ V$
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.2		0.2	V	$I_C = 10\ mA$, $I_B = 0.5\ mA$
$V_{BE(ON)}$	Base to Emitter "On" Voltage	0.5	0.7	0.5	0.7	V	$I_C = 1.0\ mA$, $V_{CE} = 5.0\ V$
C_{cb}	Collector to Base Capacitance		4.0		4.0	pF	$V_{CB} = 5.0\ V$, $I_E = 0$
C_{eb}	Emitter to Base Capacitance		6.0		6.0	pF	$V_{BE} = 0.5\ V$, $I_C = 0$
$\|h_{fe}\|$	Magnitude of Common Emitter Small Signal Current Gain	1.0		1.0			$I_C = 10\ mA$, $V_{CE} = 5.0\ V$, $f = 100\ MHz$
h_{fe}	Small Signal Current Gain	150	1000	650	2000		$I_C = 10\ mA$, $V_{CE} = 5.0\ V$, $f = 1.0\ kHz$
NF	Narrow Band Noise Figure		6.0		6.0	dB	$I_C = 100\ \mu A$, $V_{CE} = 5.0\ V$, $f = 1.0\ kHz$, $R_S = 1.0\ k\Omega$, $BW = 400\ Hz$
					4.0	dB	$I_C = 100\ \mu A$, $V_{CE} = 5.0\ V$, $f = 1.0\ kHz$, $R_S = 10\ k\Omega$, $BW = 400\ Hz$
					8.0	dB	$I_C = 100\ \mu A$, $V_{CE} = 5.0\ V$, $f = 1.0\ kHz$, $R_S = 100\ k\Omega$, $BW = 400\ Hz$
			3.0		3.0	dB	$I_C = 10\ \mu A$, $V_{CE} = 5.0\ V$, $f = 1.0\ kHz$, $R_S = 10\ k\Omega$, $BW = 400\ Hz$
NF	Wide Band Noise Figure		3.0		3.0	dB	$I_C = 10\ \mu A$, $V_{CE} = 5.0\ V$, $R_S = 10\ k\Omega$, $BW = 15.7\ kHz$, $f = 10\ Hz$ to $10\ kHz$

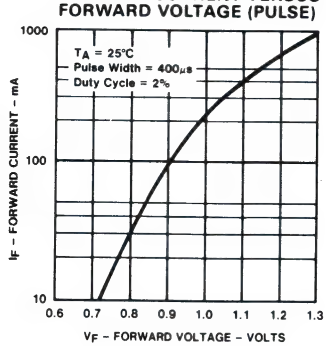
Product Family Curves
Curve Set number D1

Typical Electrical Characteristic Curves
25° C Ambient Temperature unless otherwise noted

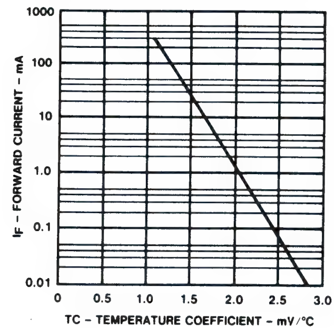
DC FORWARD CURRENT VERSUS FORWARD VOLTAGE



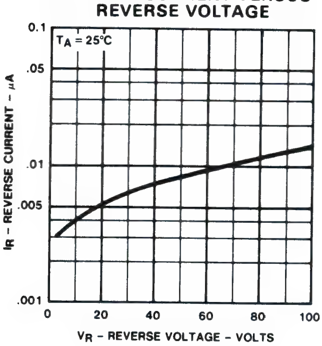
FORWARD CURRENT VERSUS FORWARD VOLTAGE (PULSE)



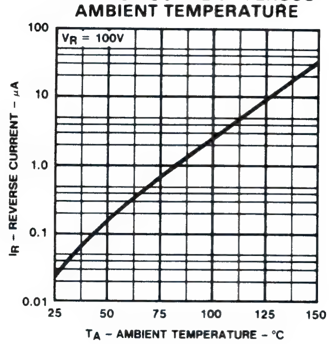
DC FORWARD CURRENT VERSUS TEMPERATURE COEFFICIENT



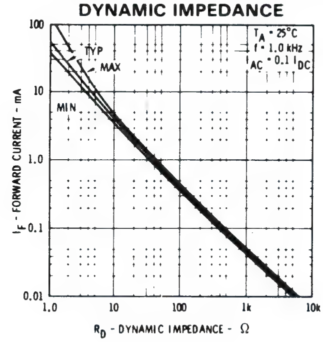
REVERSE CURRENT VERSUS REVERSE VOLTAGE



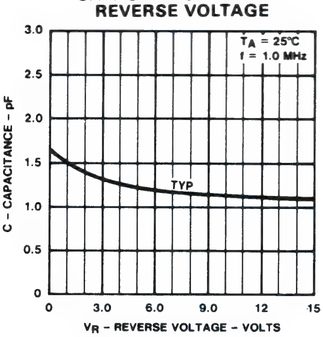
REVERSE CURRENT VERSUS AMBIENT TEMPERATURE



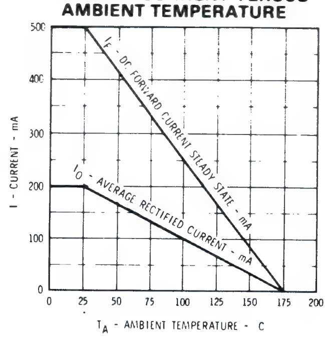
FORWARD CURRENT VERSUS DYNAMIC IMPEDANCE



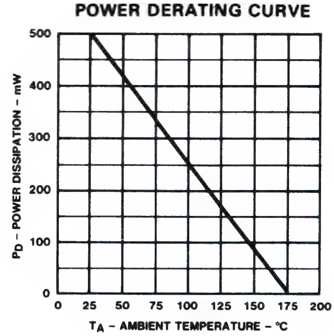
CAPACITANCE VERSUS REVERSE VOLTAGE



AVERAGE RECTIFIED CURRENT AND FORWARD CURRENT VERSUS AMBIENT TEMPERATURE



POWER DERATING CURVE



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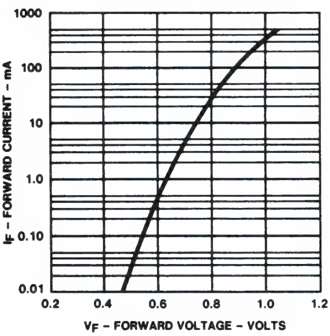
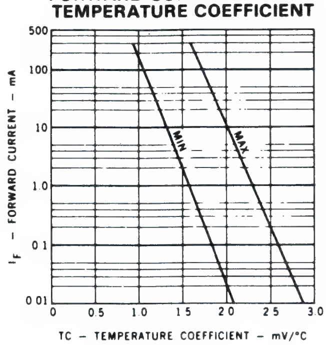
Curve Set number D2

Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

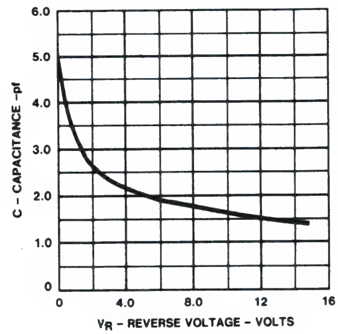
FORWARD VOLTAGE VERSUS FORWARD CURRENT



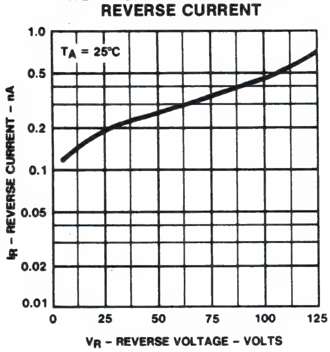
FORWARD CURRENT VERSUS TEMPERATURE COEFFICIENT



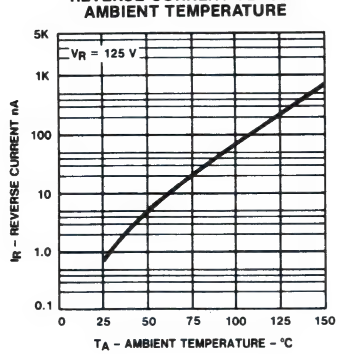
CAPACITANCE VERSUS REVERSE VOLTAGE



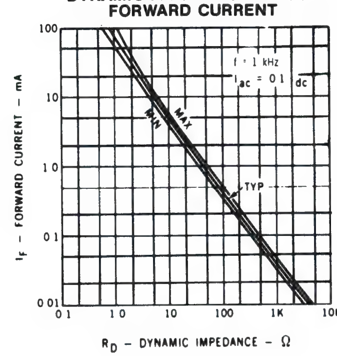
REVERSE VOLTAGE VERSUS REVERSE CURRENT



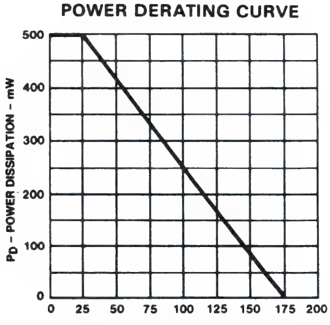
REVERSE CURRENT VERSUS AMBIENT TEMPERATURE



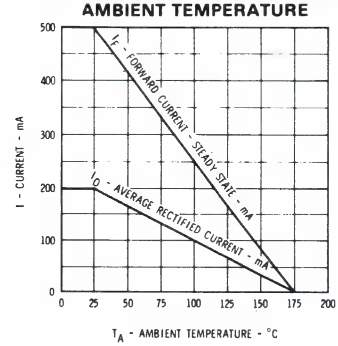
DYNAMIC IMPEDANCE VERSUS FORWARD CURRENT



POWER DERATING CURVE



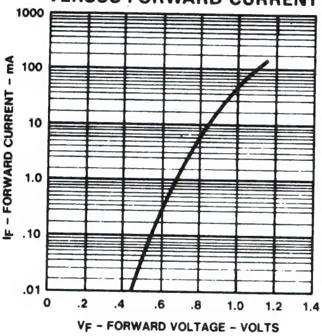
AVERAGE RECTIFIED CURRENT AND FORWARD CURRENT VERSUS AMBIENT TEMPERATURE



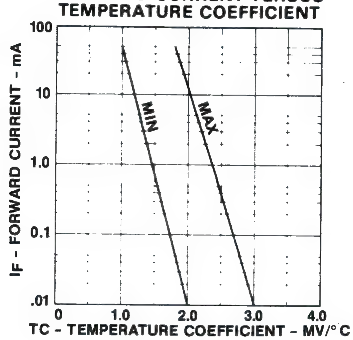
Curve Set number D3

Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

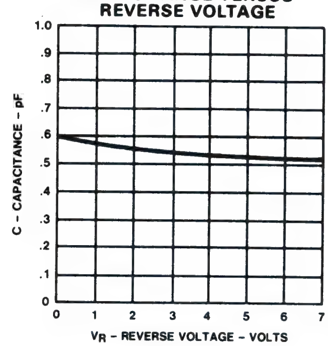
FORWARD VOLTAGE VERSUS FORWARD CURRENT



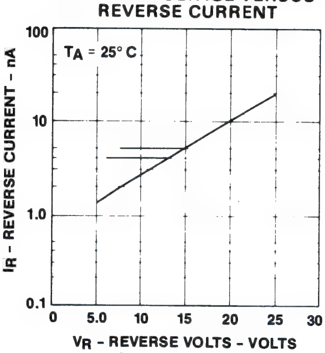
FORWARD CURRENT VERSUS TEMPERATURE COEFFICIENT



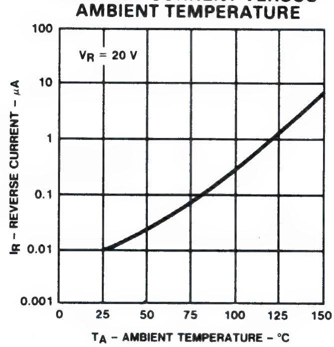
CAPACITANCE VERSUS REVERSE VOLTAGE



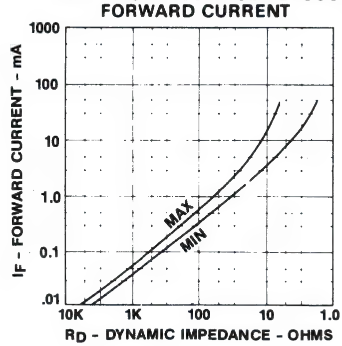
REVERSE VOLTAGE VERSUS REVERSE CURRENT



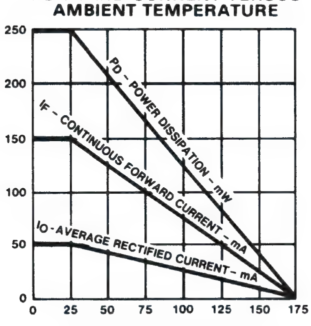
REVERSE CURRENT VERSUS AMBIENT TEMPERATURE



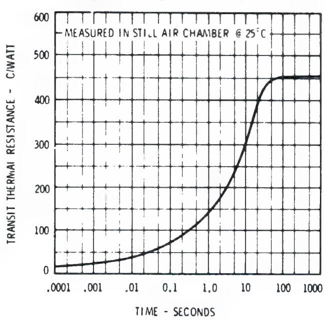
DYNAMIC IMPEDANCE VERSUS FORWARD CURRENT



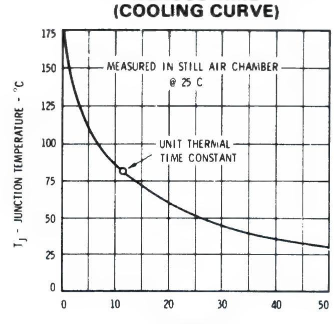
POWER DISSIPATION, AVERAGE RECTIFIED CURRENT AND FORWARD CURRENT VERSUS AMBIENT TEMPERATURE



TRANSIENT THERMAL RESISTANCE VERSUS TIME



JUNCTION TEMPERATURE VERSUS TIME (COOLING CURVE)



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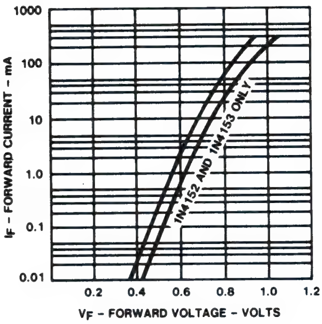
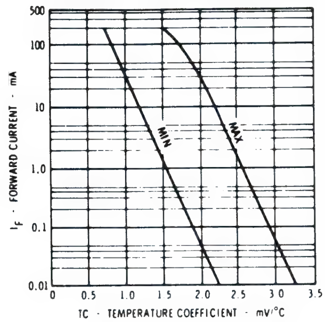
Curve Set number D4

Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

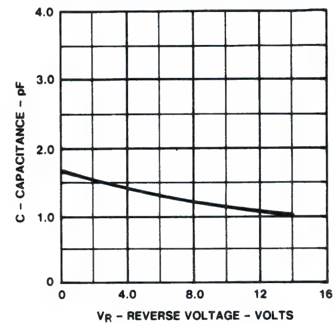
FORWARD VOLTAGE VERSUS FORWARD CURRENT



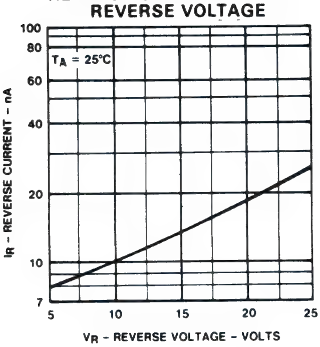
FORWARD CURRENT VERSUS TEMPERATURE COEFFICIENT



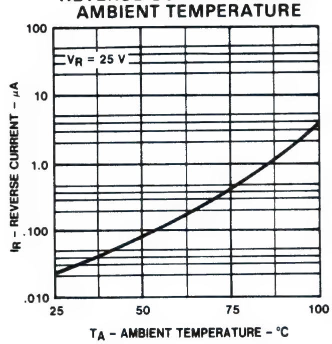
CAPACITANCE VERSUS REVERSE VOLTAGE



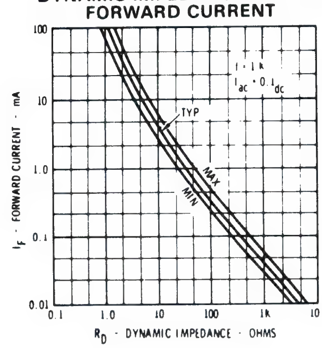
REVERSE CURRENT VERSUS REVERSE VOLTAGE



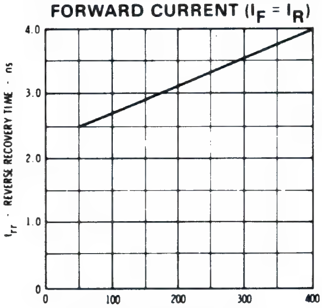
REVERSE CURRENT VERSUS AMBIENT TEMPERATURE



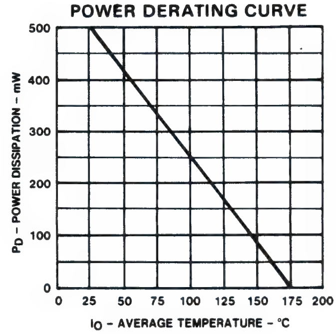
DYNAMIC IMPEDANCE VERSUS FORWARD CURRENT



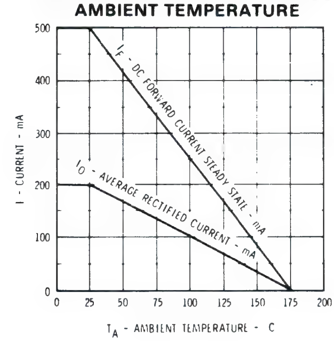
REVERSE RECOVERY TIME VERSUS FORWARD CURRENT ($I_F = I_R$)



POWER DERATING CURVE



AVERAGE RECTIFIED CURRENT AND FORWARD CURRENT VERSUS AMBIENT TEMPERATURE

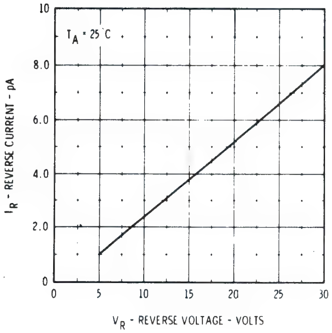


Curve Set number D6

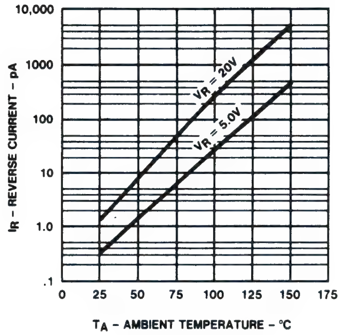
Typical Electrical Characteristic Curves

25° C Ambient Temperature unless otherwise noted

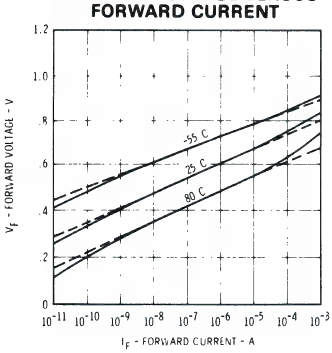
REVERSE CURRENT VERSUS REVERSE VOLTAGE



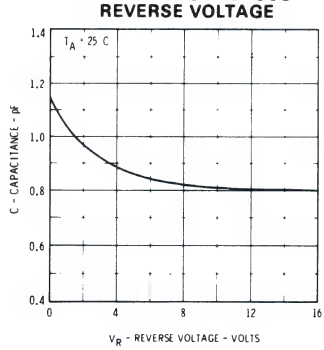
REVERSE CURRENT VERSUS TEMPERATURE



FORWARD VOLTAGE VERSUS FORWARD CURRENT



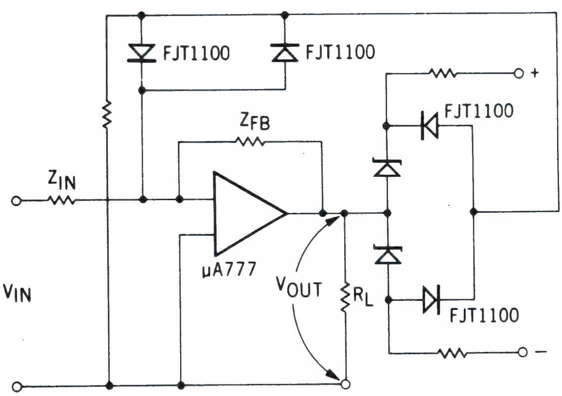
CAPACITANCE VERSUS REVERSE VOLTAGE



Curve Set number D6

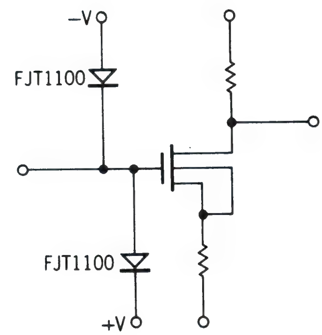
Test Circuits

A BOUND CIRCUIT FOR OPERATIONAL AMPLIFIERS



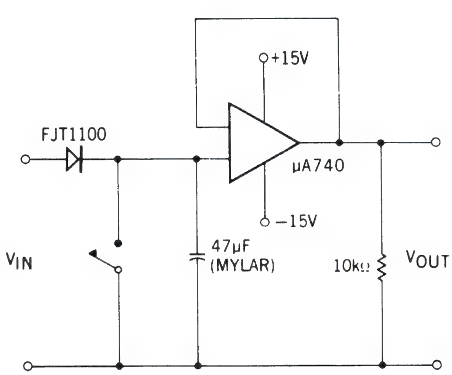
The bound circuit prevents overloading and saturation of operational amplifiers. The circuit has negligible effect on the operational amplifier until overload conditions occur. The use of the low leakage picoampere diode permits realization of extremely high input impedance for normal input voltages.

MOS FET PROTECTION CIRCUIT

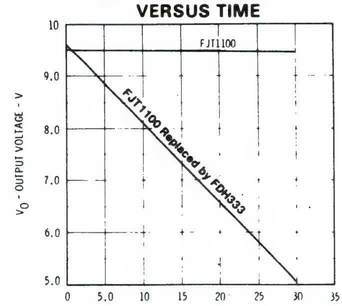


The picoampere diode affords excellent gate voltage protection while maintaining the DC input impedance at about one million megohms. In addition the very low capacity of the FJT1100 will have a relatively small effect on the circuit input capacity.

PEAK FOLLOWER CIRCUIT



OUTPUT VOLTAGE OF THE PEAK FOLLOWER CIRCUIT VERSUS TIME



A nearly constant voltage peak follower circuit is available by using a picoampere diode. A comparison between the use of the FJT1100 and a "low leakage" FDH333 diode in the circuit is shown in the curves of V_{OUT} vs Time.

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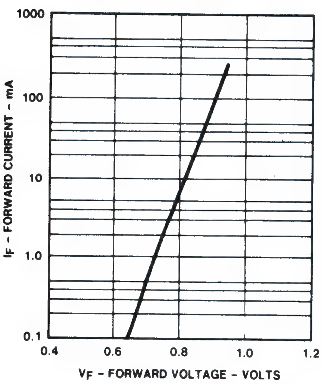
Curve Set number D7

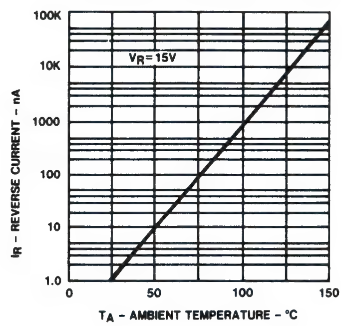
Typical Electrical Characteristic Curves

25° C Ambient Temperature unless otherwise noted

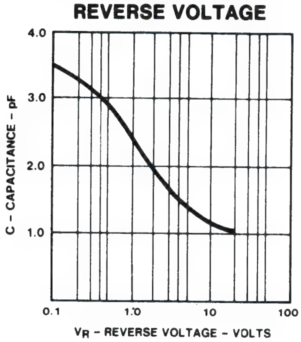
FORWARD CURRENT VERSUS FORWARD VOLTAGE



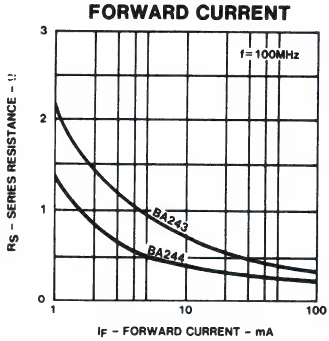
REVERSE CURRENT VERSUS AMBIENT TEMPERATURE



CAPACITANCE VERSUS REVERSE VOLTAGE



SERIES RESISTANCE VERSUS FORWARD CURRENT



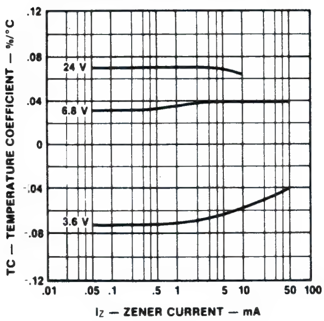
4

Curve Set number D13

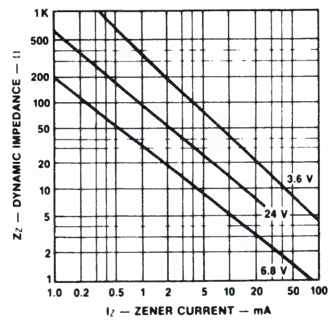
Typical Electrical Characteristic Curves

25° C Ambient Temperature unless otherwise noted

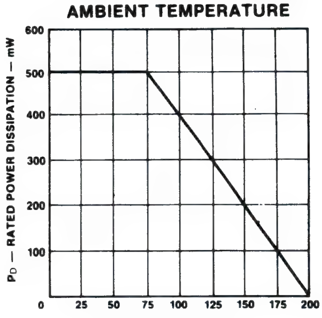
TEMPERATURE COEFFICIENT VERSUS ZENER CURRENT



DYNAMIC IMPEDANCE VERSUS ZENER CURRENT



POWER DERATING VERSUS AMBIENT TEMPERATURE

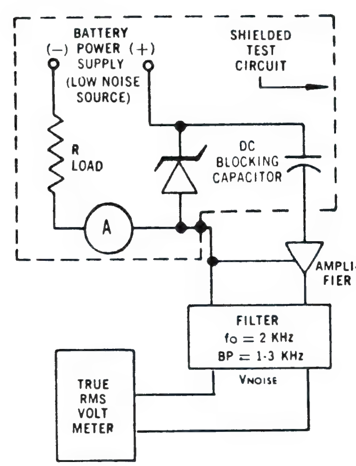


Test Circuit

NOISE DENSITY MEASUREMENT CIRCUIT

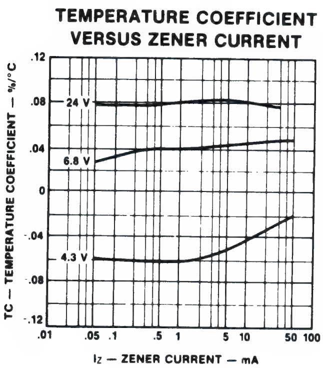
1N4099 - 1N4121

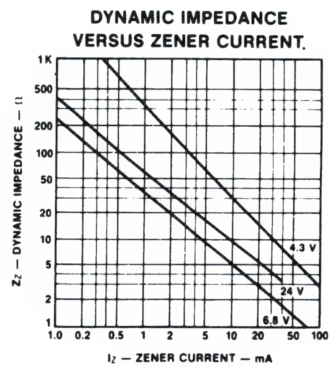
1N4620 - 1N4627

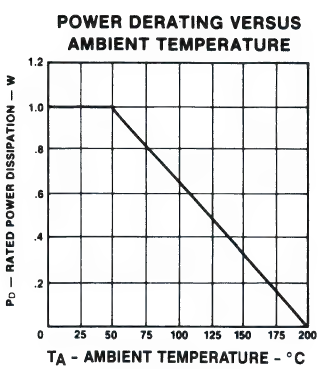


Curve Set number D14

Typical Electrical Characteristic Curves
25° C Ambient Temperature unless otherwise noted





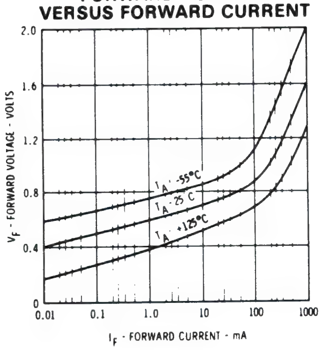


4

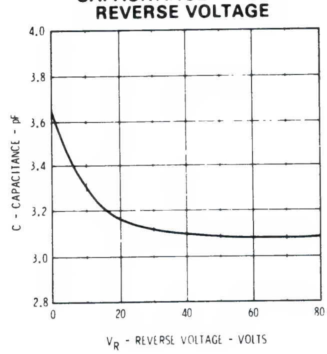
Curve Set number D15

Typical Electrical Characteristic Curves
25° C Ambient Temperature unless otherwise noted

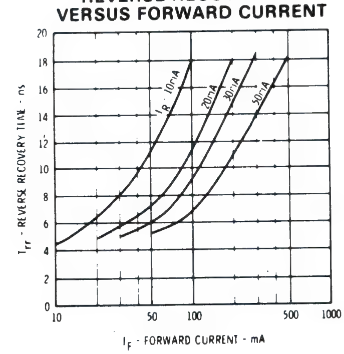
FORWARD VOLTAGE VERSUS FORWARD CURRENT



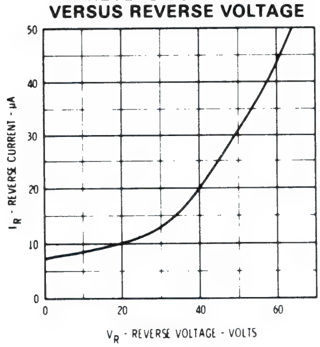
CAPACITANCE VERSUS REVERSE VOLTAGE



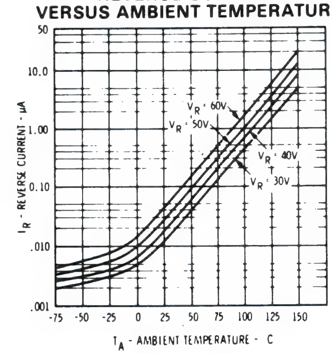
REVERSE RECOVER TIME VERSUS FORWARD CURRENT



REVERSE CURRENT VERSUS REVERSE VOLTAGE



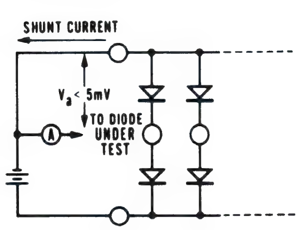
REVERSE CURRENT VERSUS AMBIENT TEMPERATURE



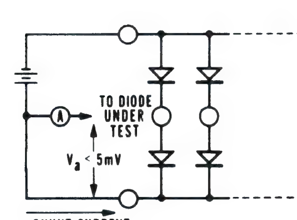
TEST CIRCUITS

To measure reverse current of an individual diode, the following test circuits are used:

COMMON CATHODE DIODES

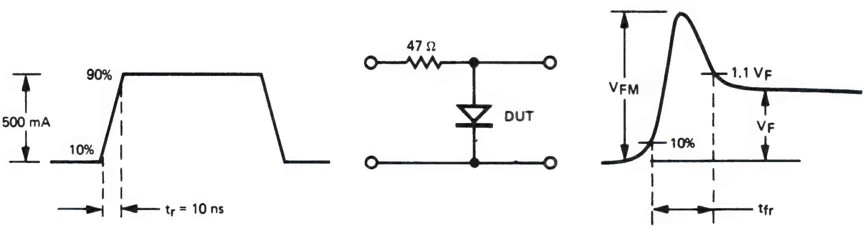


COMMON ANODE DIODES



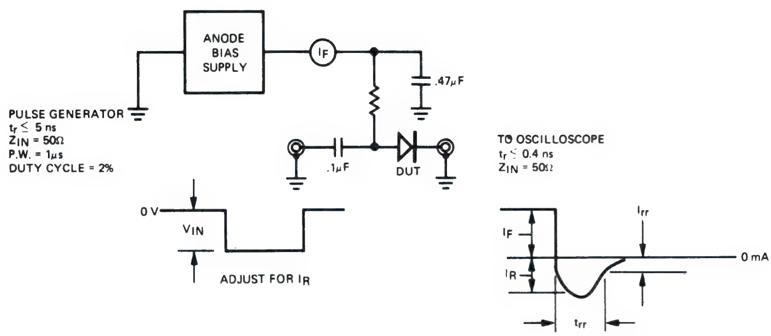
TEST CIRCUITS continued

Test requirement for V_{FM} and t_{fr} is as shown below; all leads should be as short as possible.

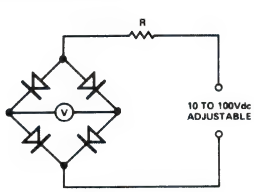


t_{rr} - REVERSE RECOVERY TIME TEST CIRCUIT

$I_f = I_r$, $I_{rr} = 0.1\ I_r$



ΔV_F BRIDGE MATCHING CIRCUIT



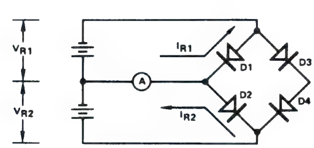
NOTES:

1. R Varies depending on the current range. For the most often used current ranges, R is as follows:

Current Range (amperes)	R (ohms)
10^{-5} to 10^{-4}	10^{6}
10^{-4} to 10^{-3}	10^{5}
10^{-3} to 10^{-2}	10^{4}
or 10^{-n} to 10^{-n+1}	10^{n+1}

2. V indicates mismatch of assembly.

ΔI_R BRIDGE MATCHING CIRCUIT



NOTES:

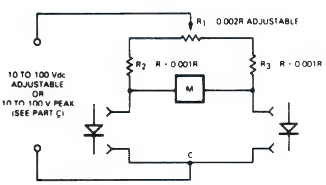
1. $V_{R2} = V_{R1}$ ±1%.
2. $I_{R2} - I_{R1} = \Delta I_R$ (difference in I_R between diodes D1 & D2). To measure diodes D3 & D4, reverse cathode-anodeterminal connections.
3. A is a center reading pico ammeter. ΔI_R indicated directly on A.

FAIRCHILD
A Schlumberger Company

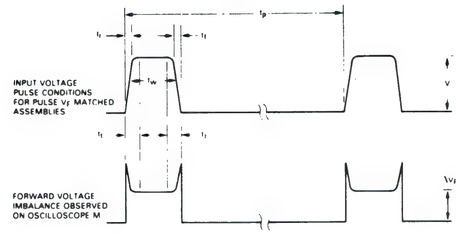
Curve Set number D18

Test Circuits
ΔV_F DIODE MATCHING CIRCUITS.

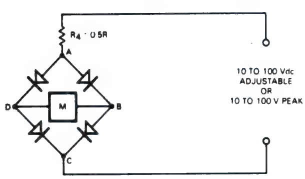
a.



b.



c.



t_r	Pulse Rise Time (10 to 90% Amplitude)	= 1.0 μs Max.
t_f	Pulse Fall Time (90 to 10% Amplitude)	= 1.0 μs Max.
t_w	Pulse Width (50% Amplitude)	= 10 ± 2.0 μs
t_t	Transient Time	= 1.0 μs Min.
t_p	Period	= 1.0 ms
V	Voltage Input to Circuit "A or B"	= 10 to 100 V Adjustable
ΔV_F	Forward Voltage Difference Between Diodes (Measured Between Transient Times)	= As Specified

NOTES:
1. R varies depending on the current range. For the most often used current ranges, R is as follows:

Current Range (amperes)	R (ohms)
10^{-5} to 10^{-4}	10^6
10^{-4} to 10^{-3}	10^5
10^{-3} to 10^{-2}	10^4
or 10^{-n} to 10^{-n+1}	10^{n+1}

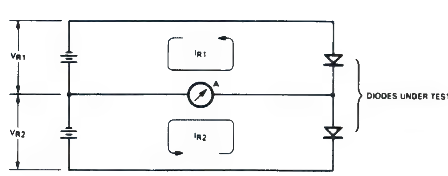
2. The input voltage pulse conditions shown above are employed at Fairchild in testing. The user may deviate from the specific conditions above with no variation in results providing the following general conditions are met:

   a. $\frac{tw}{tp} \leqslant 0.01$

   b. tw < 10 ms

   c. Transients occuring during pulse rise and fall times are ignored in observing ΔV_F.

ΔI_R DIODE MATCHING CIRCUIT



NOTES:
1. $V_{R2} = -V_{R1}$ ±1%.
2. $I_{R2} - I_{R1} = \Delta I_R$ (difference in I_R between two diodes under test).
3. A is a center reading pico ammeter.

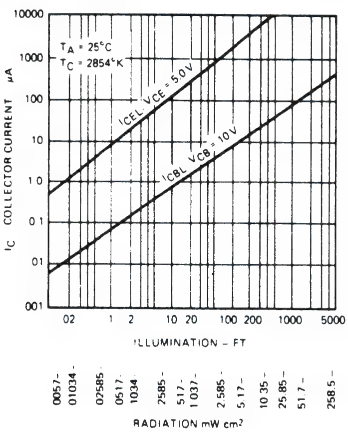
FAIRCHILD
A Schlumberger Company

FPT100 Curve Set

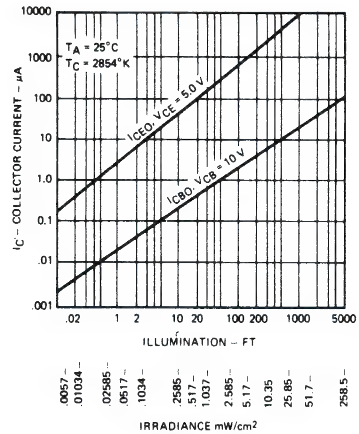
4

Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

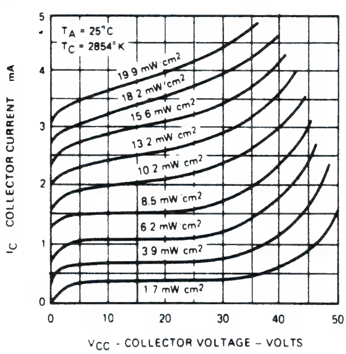
FPT100/A/B Photo Current Characteristics



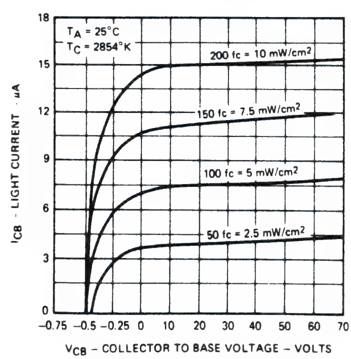
FPT110/A/B Photo Current Characteristics



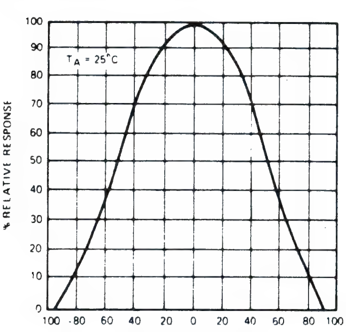
Collector Current vs Collector Voltage



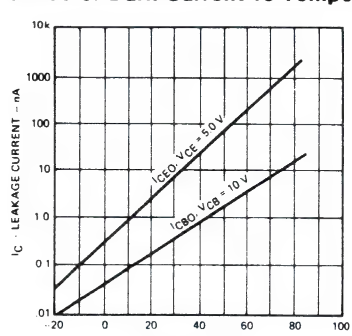
Collector Base Characteristics



Angular Response



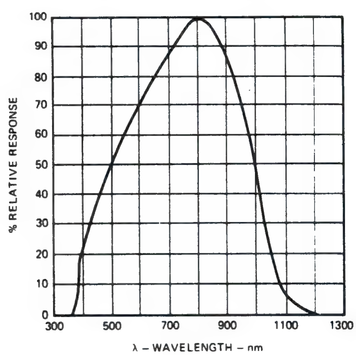
Collector Dark Current vs Temperature



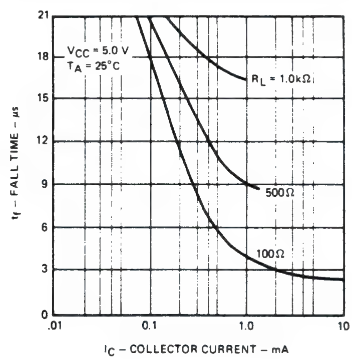
Typical Electrical Characteristic Curves

25° C Ambient Temperature unless otherwise noted

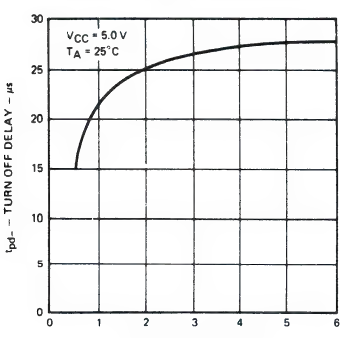
Spectral Characteristics



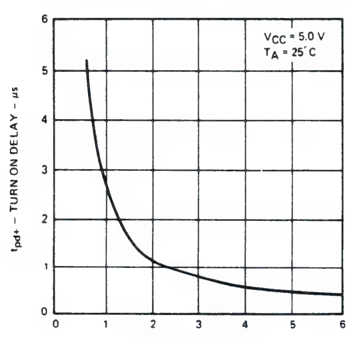
Rise And Fall Time vs Collector Current



Turn-Off Delay Times For Circuit



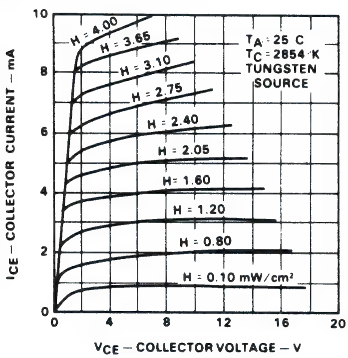
Turn-On Delay Times For Circuit



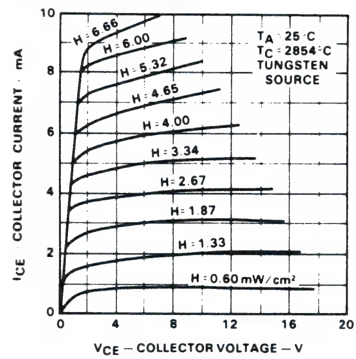
FPT120 Curve Set

Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

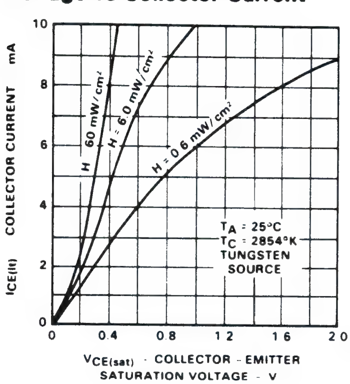
FPT120/A/B/C Collector Current vs Collector Voltage



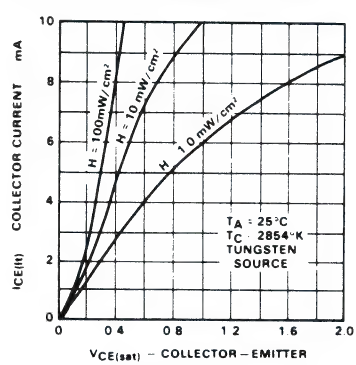
FPT130/A/B/C Collector Current vs Collector Voltage



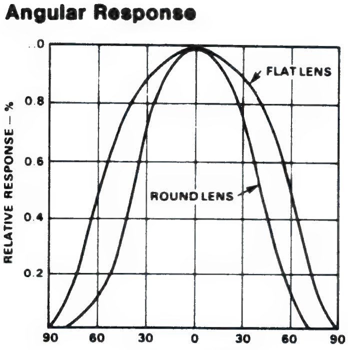
Collector-Emitter Saturation Voltage vs Collector Current



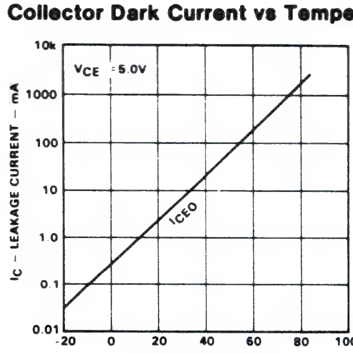
Collector-Emitter Saturation Voltage vs Collector Current



Angular Response

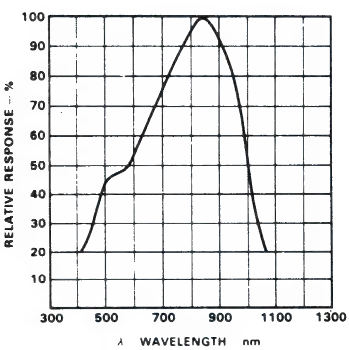


Collector Dark Current vs Temperature



Typical Electrical Characteristic Curves
25° C Ambient Temperature unless otherwise noted

Relative Spectral Response



Rise And Fall Time vs Collector Current

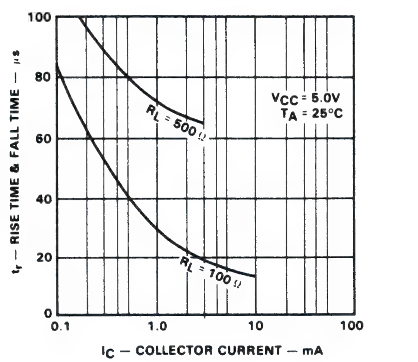
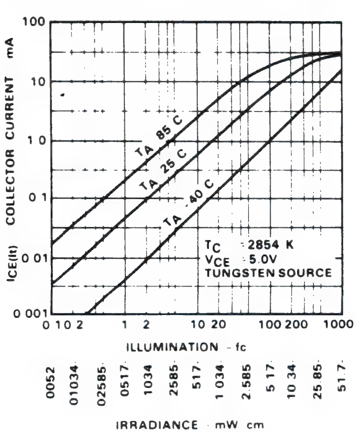


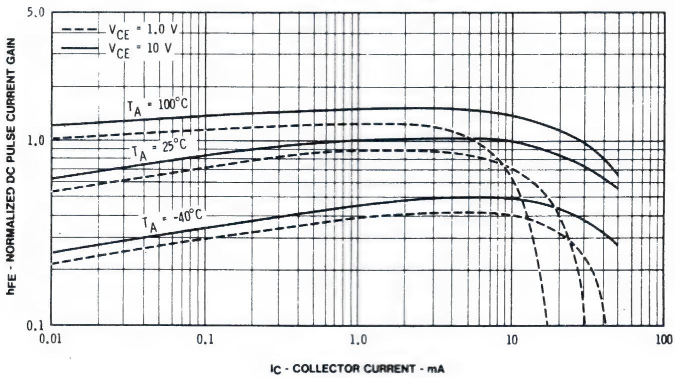
Photo Current Characteristics



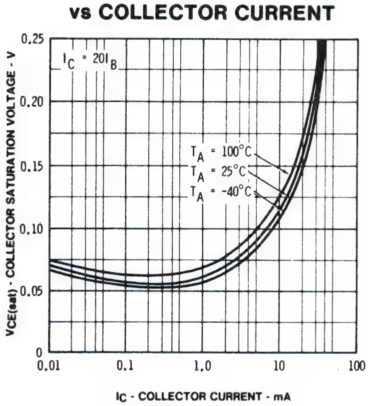
Curve Set number T107

Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

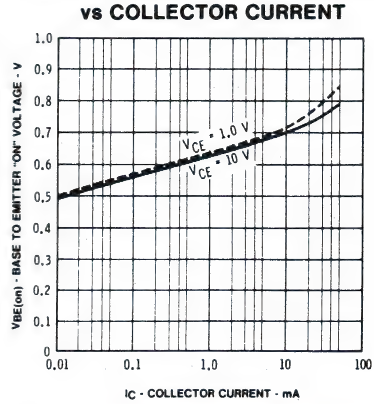
NORMALIZED DC PULSE CURRENT GAIN vs COLLECTOR CURRENT



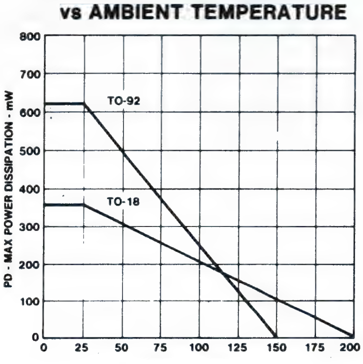
COLLECTOR SATURATION VOLTAGE vs COLLECTOR CURRENT



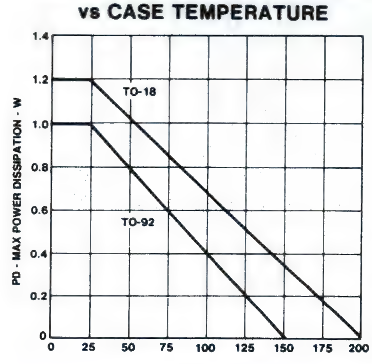
BASE TO EMITTER "ON" VOLTAGE vs COLLECTOR CURRENT



MAXIMUM POWER DISSIPATION vs AMBIENT TEMPERATURE



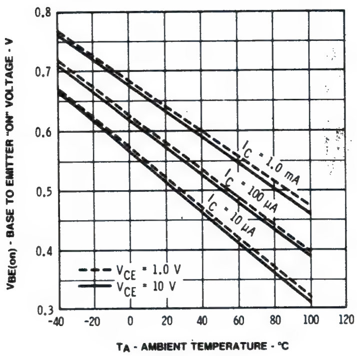
MAXIMUM POWER DISSIPATION vs CASE TEMPERATURE



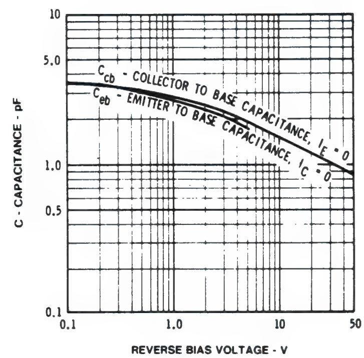
Curve Set number T107

Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

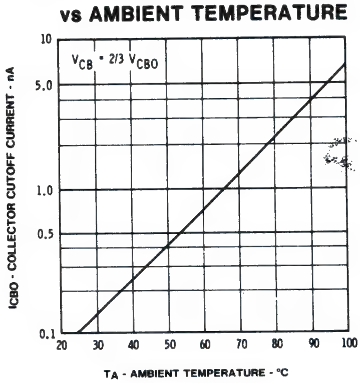
BASE TO EMITTER "ON" VOLTAGE vs AMBIENT TEMPERATURE



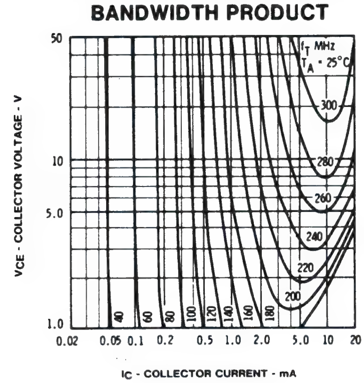
CAPACITANCE vs REVERSE BIAS VOLTAGE



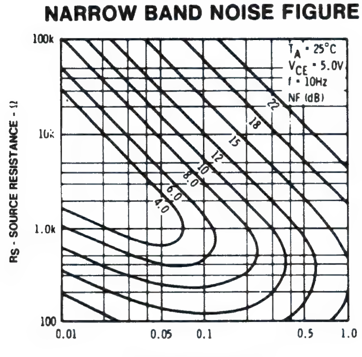
COLLECTOR CUTOFF CURRENT vs AMBIENT TEMPERATURE



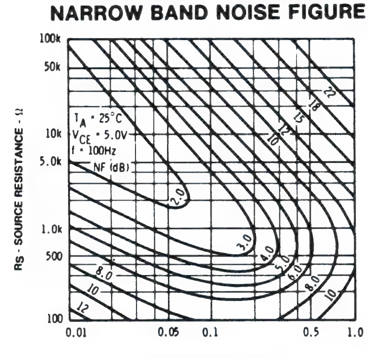
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT



CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE

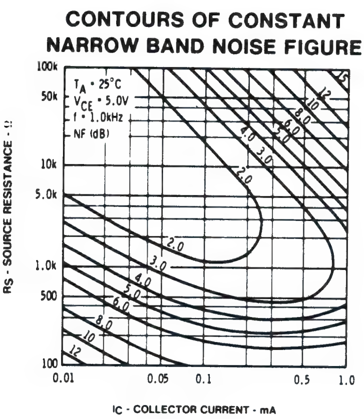


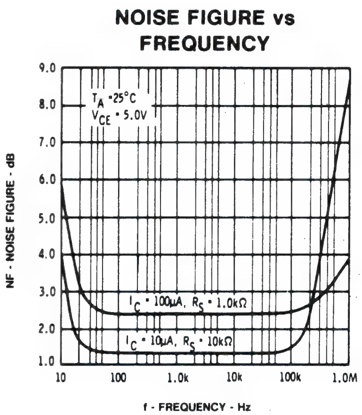
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



Typical Electrical Characteristic Curves

25° C Ambient Temperature unless otherwise noted





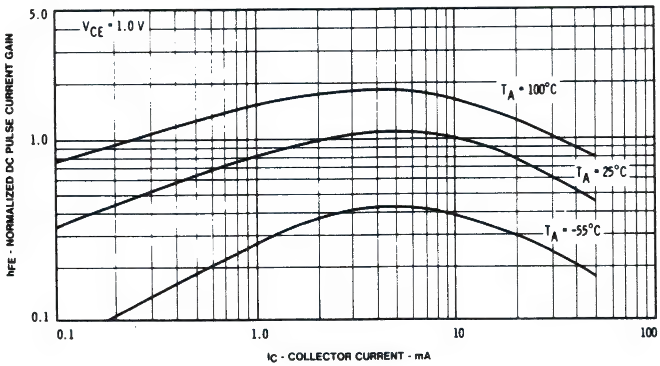
FAIRCHILD

A Schlumberger Company

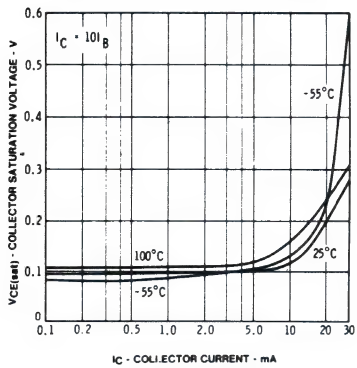
Curve Set number T121

Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

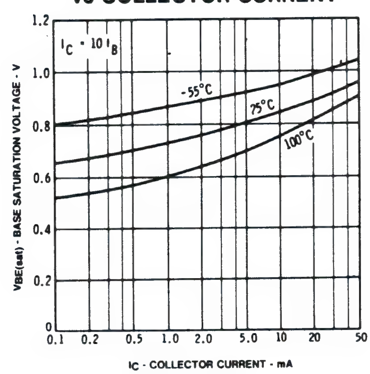
NORMALIZED DC PULSE CURRENT GAIN vs COLLECTOR CURRENT



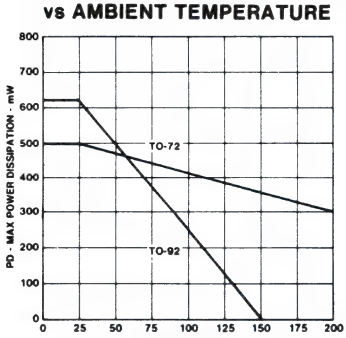
COLLECTOR SATURATION VOLTAGE vs COLLECTOR CURRENT



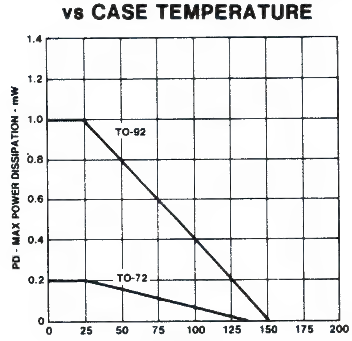
BASE SATURATION VOLTAGE vs COLLECTOR CURRENT



MAXIMUM POWER DISSIPATION vs AMBIENT TEMPERATURE



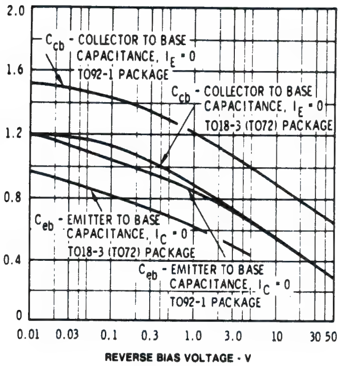
MAXIMUM POWER DISSIPATION vs CASE TEMPERATURE



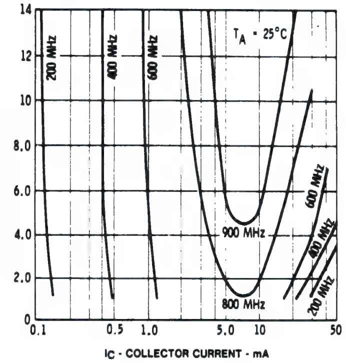
Curve Set number T121

Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

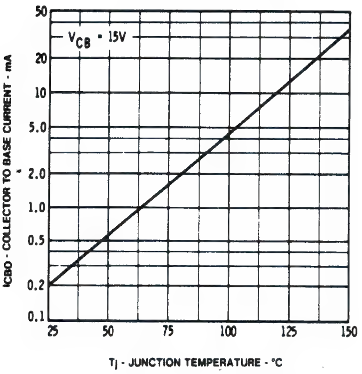
CAPACITANCE vs REVERSE BIAS VOLTAGE



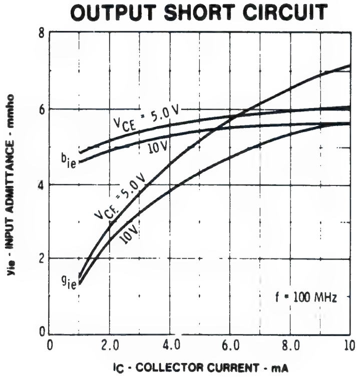
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT



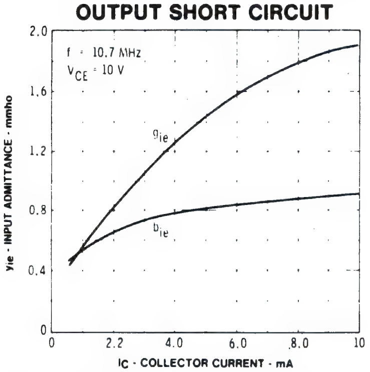
COLLECTOR TO BASE DIODE REVERSE CURRENT vs TEMPERATURE



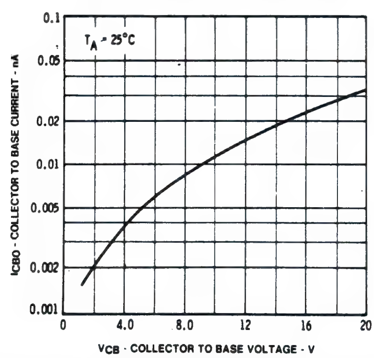
100 MHz INPUT ADMITTANCE vs COLLECTOR CURRENT OUTPUT SHORT CIRCUIT



10.7 MHz INPUT ADMITTANCE OUTPUT SHORT CIRCUIT



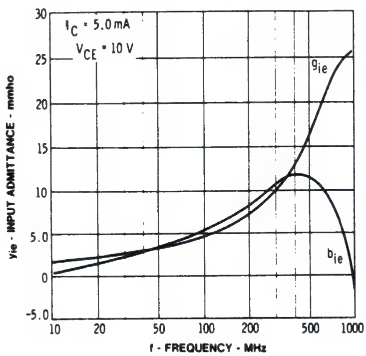
COLLECTOR CUTOFF CURRENT vs REVERSE BIAS VOLTAGE



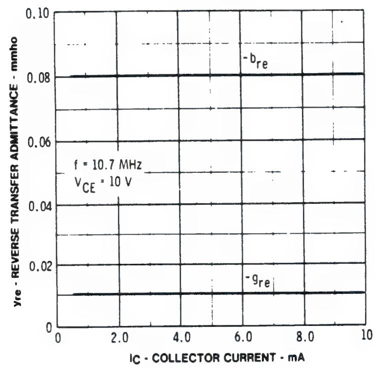
Curve Set number T121

Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

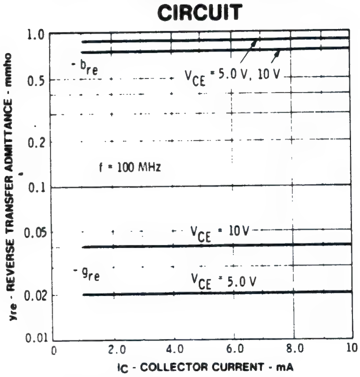
INPUT ADMITTANCE vs FREQUENCY OUTPUT SHORT CIRCUIT



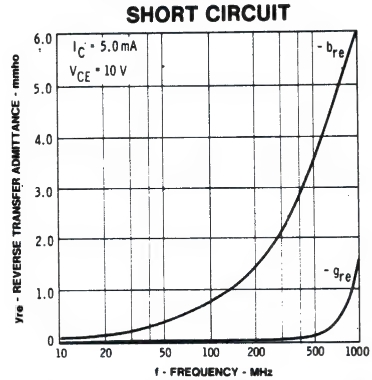
10.7 MHz REVERSE TRANSFER ADMITTANCE INPUT SHORT CIRCUIT



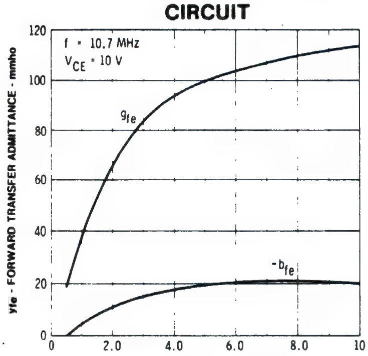
100 MHz REVERSE TRANSFER ADMITTANCE INPUT SHORT CIRCUIT



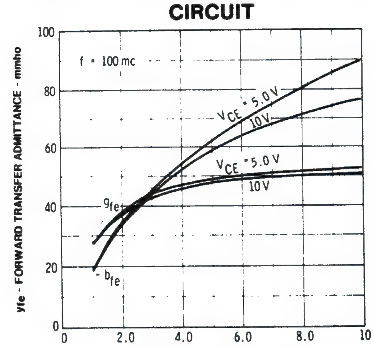
REVERSE TRANSFER ADMITTANCE vs FREQUENCY INPUT SHORT CIRCUIT



10.7 MHz FORWARD TRANSFER ADMITTANCE OUTPUT SHORT CIRCUIT



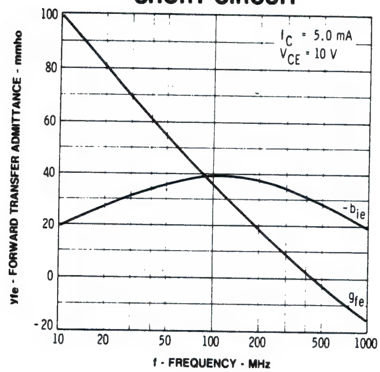
100 MHz FORWARD TRANSFER ADMITTANCE OUTPUT SHORT CIRCUIT



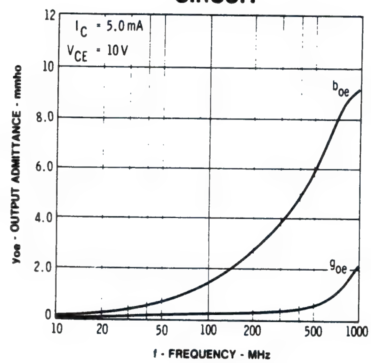
Curve Set number T121

Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

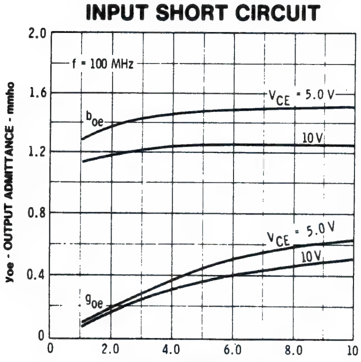
FORWARD TRANSFER ADMITTANCE vs FREQUENCY OUTPUT SHORT CIRCUIT



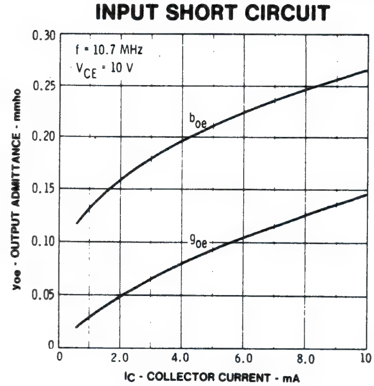
OUTPUT ADMITTANCE vs FREQUENCY INPUT SHORT CIRCUIT



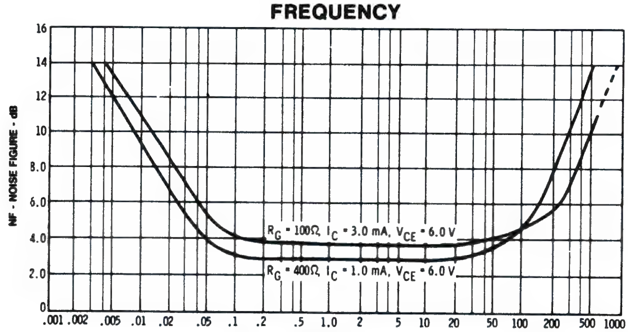
100 MHz OUTPUT ADMITTANCE INPUT SHORT CIRCUIT



10.7 MHz OUTPUT ADMITTANCE INPUT SHORT CIRCUIT

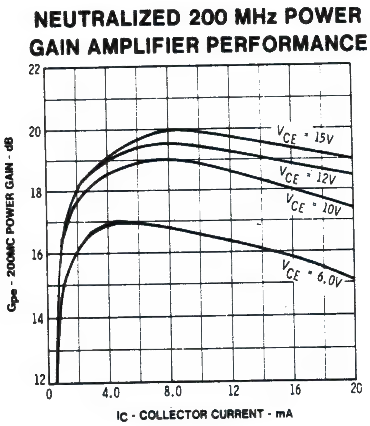


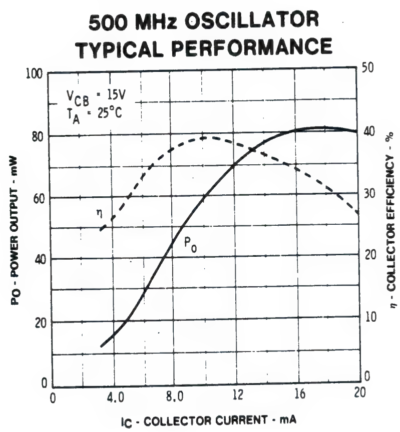
NOISE FIGURE vs FREQUENCY



Curve Set number T121

Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

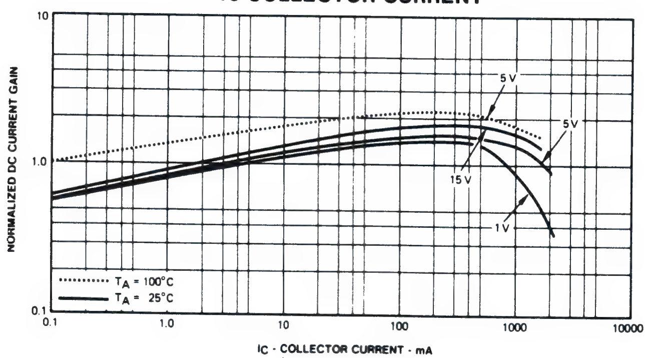




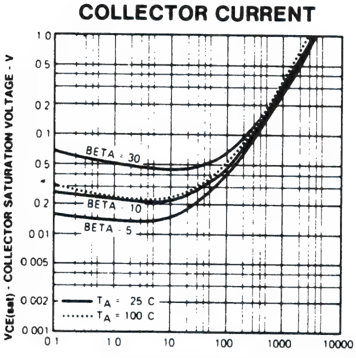
Curve Set number T124

Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

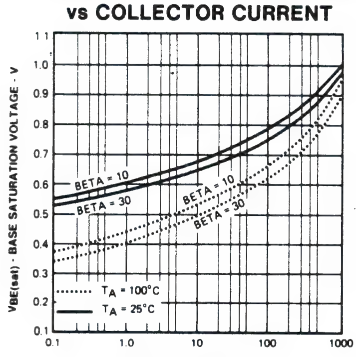
NORMALIZED DC CURRENT GAIN vs COLLECTOR CURRENT



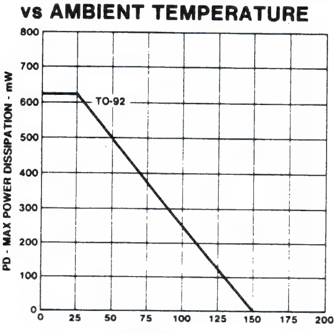
COLLECTOR SATURATION VOLTAGE vs COLLECTOR CURRENT



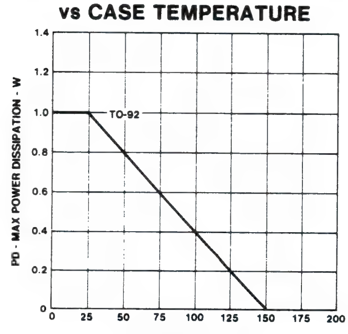
BASE SATURATION VOLTAGE vs COLLECTOR CURRENT



MAXIMUM POWER DISSIPATION vs AMBIENT TEMPERATURE

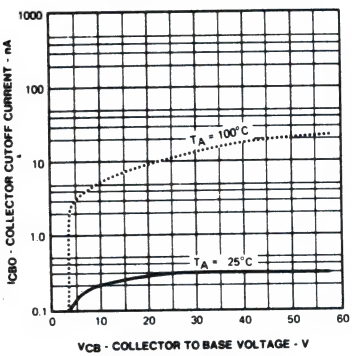


MAXIMUM POWER DISSIPATION vs CASE TEMPERATURE

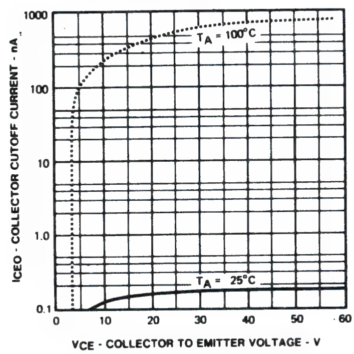


Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

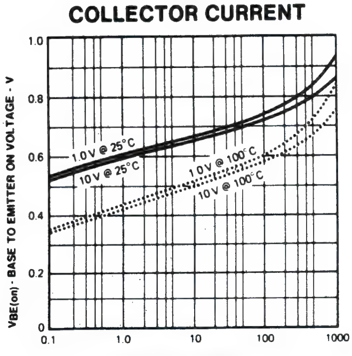
COLLECTOR CUTOFF CURRENT vs COLLECTOR TO EMITTER VOLTAGE



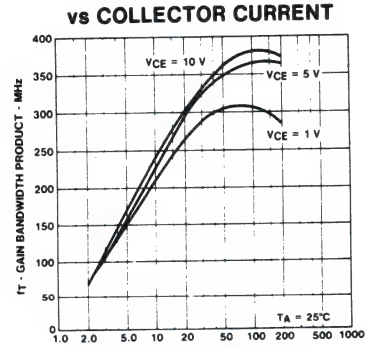
COLLECTOR CUTOFF CURRENT vs COLLECTOR TO EMITTER VOLTAGE



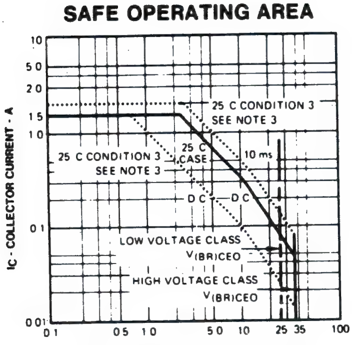
BASE TO EMITTER ON VOLTAGE vs COLLECTOR CURRENT



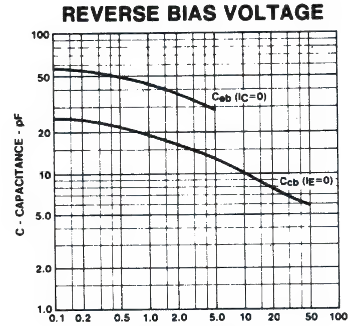
GAIN BANDWIDTH PRODUCT vs COLLECTOR CURRENT



SAFE OPERATING AREA



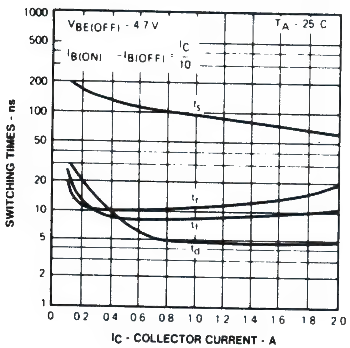
CAPACITANCE vs REVERSE BIAS VOLTAGE



Curve Set number T124

Typical Electrical Characteristic Curves
25° C Ambient Temperature unless otherwise noted

SWITCHING TIMES
vs COLLECTOR CURRENT



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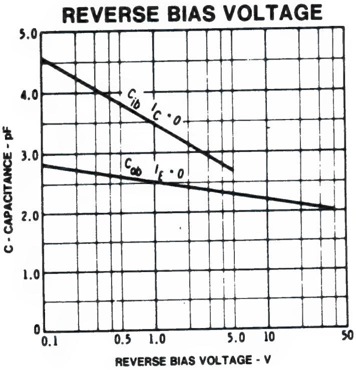
FAIRCHILD

A Schlumberger Company

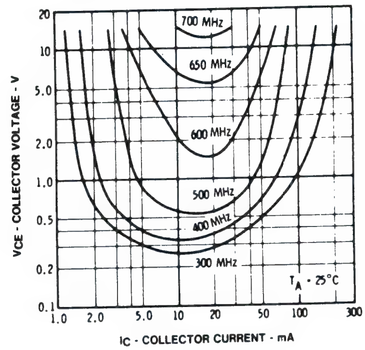
Curve Set number T132

Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

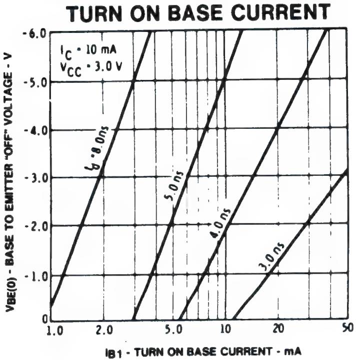
EMITTER TRANSITION AND OUTPUT CAPACITANCES vs REVERSE BIAS VOLTAGE



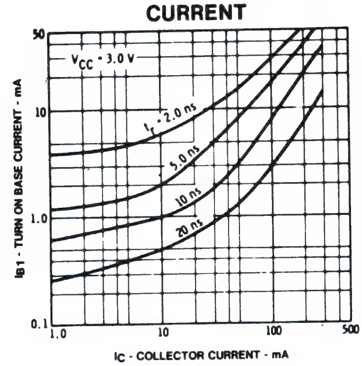
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT



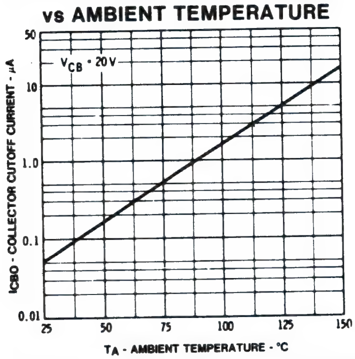
DELAY TIME vs BASE TO EMITTER "OFF" VOLTAGE AND TURN ON BASE CURRENT



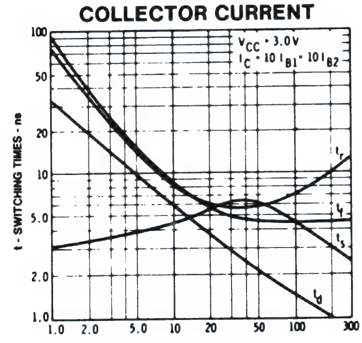
RISE TIME vs TURN ON BASE CURRENT AND COLLECTOR CURRENT



COLLECTOR CUTOFF CURRENT vs AMBIENT TEMPERATURE



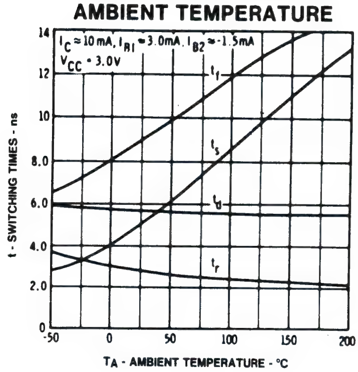
SWITCHING TIMES vs COLLECTOR CURRENT



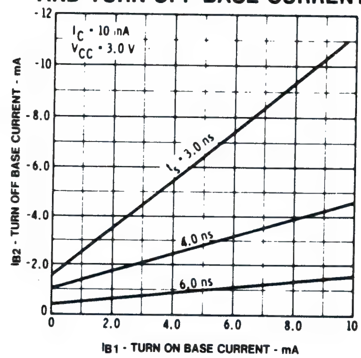
Curve Set number T132

Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

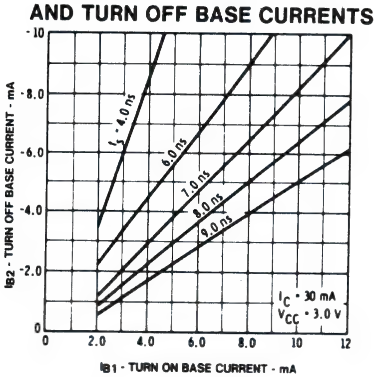
SWITCHING TIMES vs AMBIENT TEMPERATURE



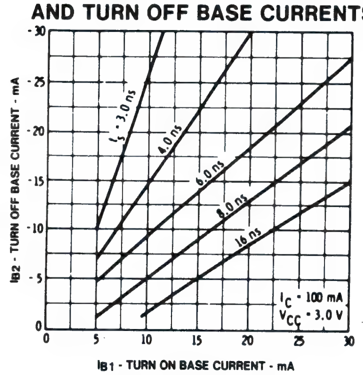
STORAGE TIME vs TURN ON AND TURN OFF BASE CURRENTS



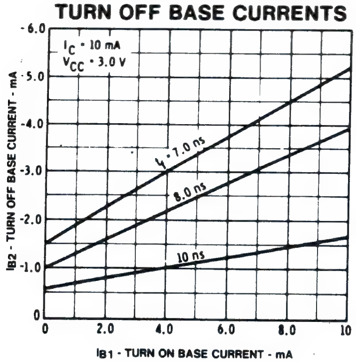
STORAGE TIME vs TURN ON AND TURN OFF BASE CURRENTS



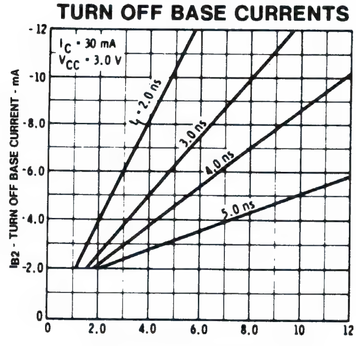
STORAGE TIME vs TURN ON AND TURN OFF BASE CURRENTS



FALL TIME vs TURN ON AND TURN OFF BASE CURRENTS



FALL TIME vs TURN ON AND TURN OFF BASE CURRENTS

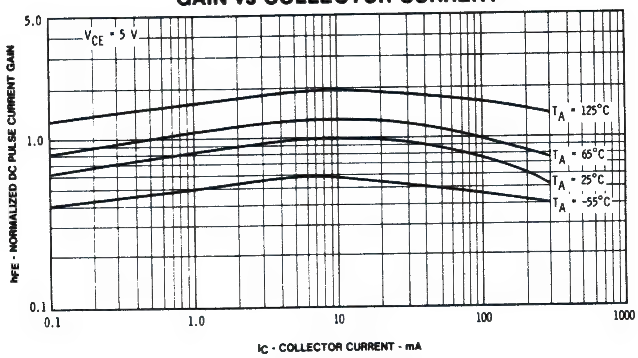


4

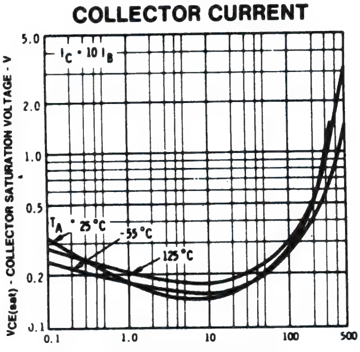
Curve Set number T132

Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

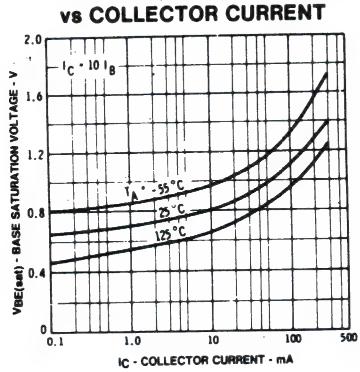
NORMALIZED DC PULSE CURRENT GAIN vs COLLECTOR CURRENT



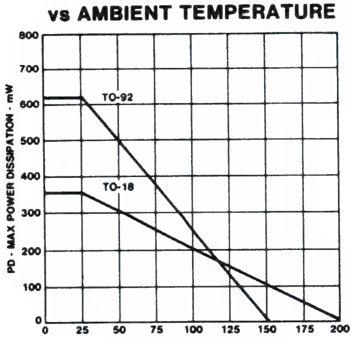
COLLECTOR SATURATION VOLTAGE vs COLLECTOR CURRENT



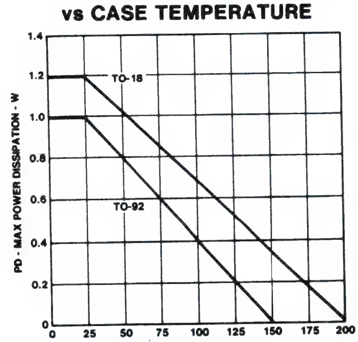
BASE SATURATION VOLTAGE vs COLLECTOR CURRENT



MAXIMUM POWER DISSIPATION vs AMBIENT TEMPERATURE



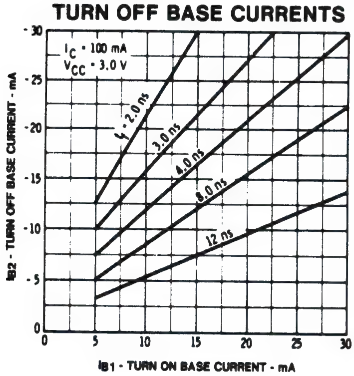
MAXIMUM POWER DISSIPATION vs CASE TEMPERATURE



Typical Electrical Characteristic Curves

25° C Ambient Temperature unless otherwise noted

FALL TIME vs TURN ON AND TURN OFF BASE CURRENTS



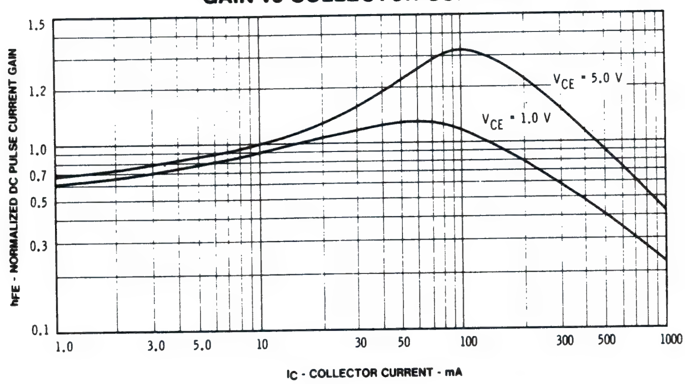
FAIRCHILD

A Schlumberger Company

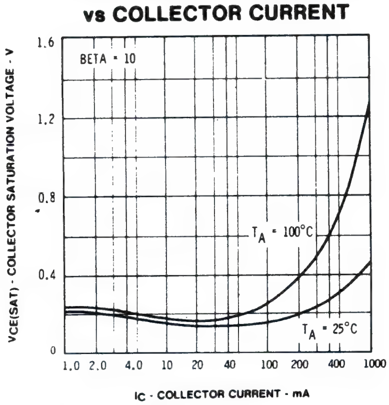
Curve Set number T139

Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

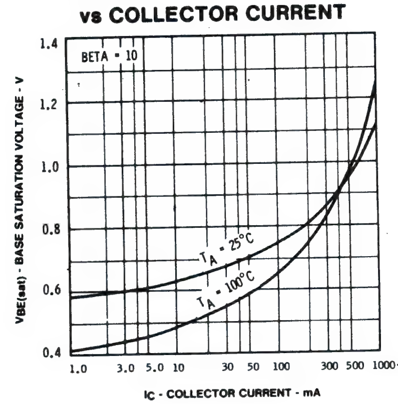
NORMALIZED DC PULSED CURRENT GAIN vs COLLECTOR CURRENT



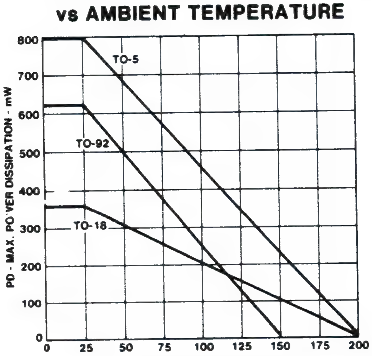
COLLECTOR SATURATION VOLTAGE vs COLLECTOR CURRENT



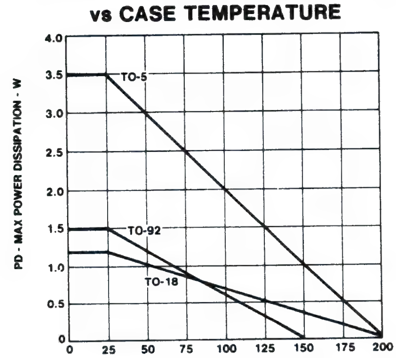
BASE SATURATION VOLTAGE vs COLLECTOR CURRENT



MAXIMUM POWER DISSIPATION vs AMBIENT TEMPERATURE



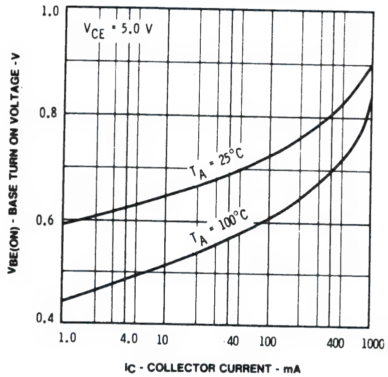
MAXIMUM POWER DISSIPATION vs CASE TEMPERATURE



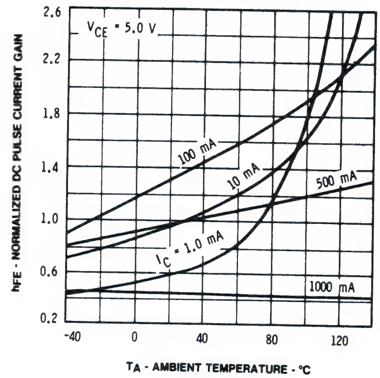
Curve Set number T139

Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

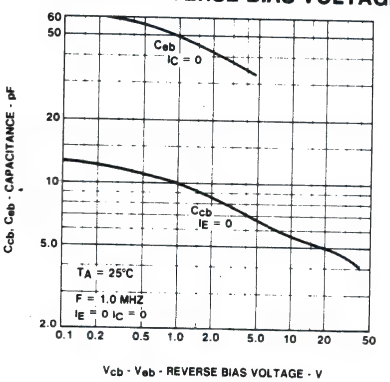
BASE TURN ON VOLTAGE vs COLLECTOR CURRENT



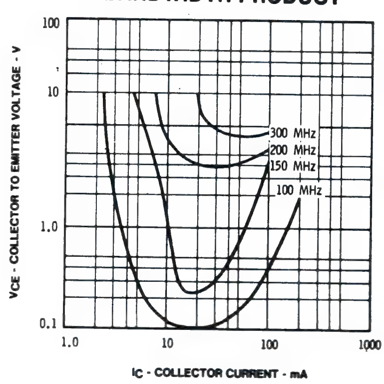
NORMALIZED DC PULSED CURRENT GAIN vs TEMPERATURE



Ccb AND Ceb vs COLLECTOR TO BASE REVERSE BIAS VOLTAGE



CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT



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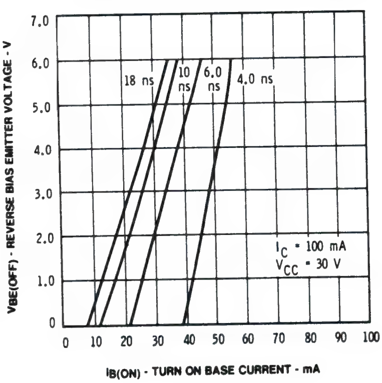
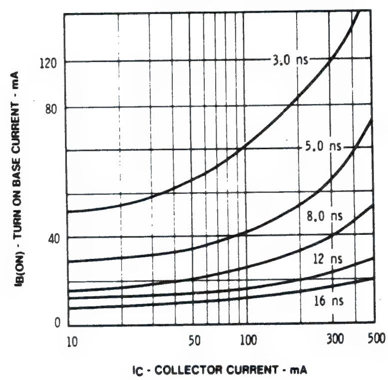
Typical Electrical Characteristic Curves
25° C Ambient Temperature unless otherwise noted

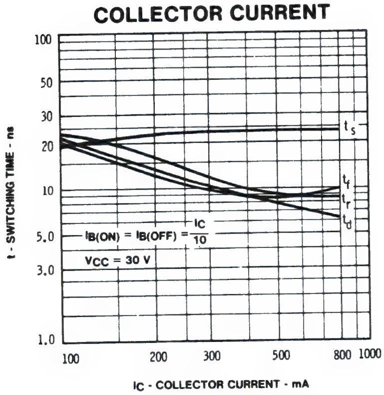
DELAY TIME vs TURN ON BASE CURRENT AND REVERSE BASE TO EMITTER VOLTAGE



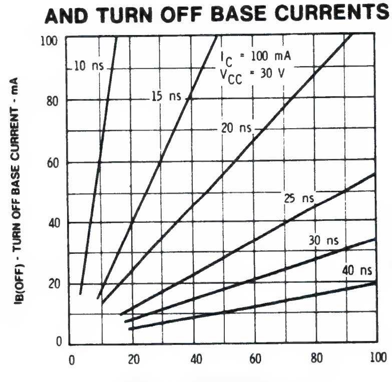
RISE TIME vs COLLECTOR CURRENT AND TURN ON BASE CURRENT



SWITCHING TIME vs COLLECTOR CURRENT

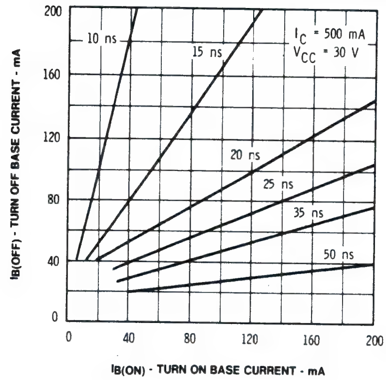


STORAGE TIME vs TURN ON AND TURN OFF BASE CURRENTS

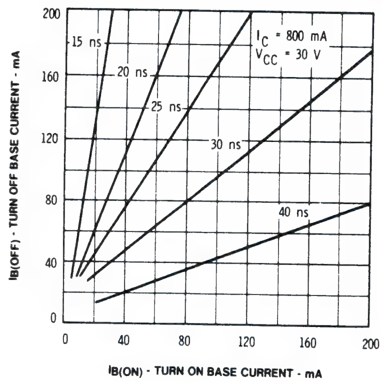


Typical Electrical Characteristic Curves
25° C Ambient Temperature unless otherwise noted

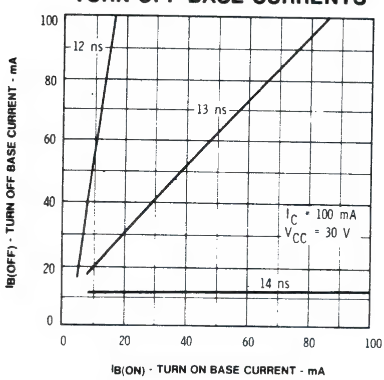
STORAGE TIME vs TURN ON AND TURN OFF BASE CURRENTS



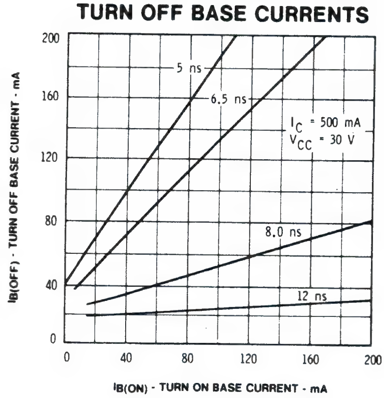
STORAGE TIME vs TURN ON AND TURN OFF BASE CURRENTS



FALL TIME vs TURN ON AND TURN OFF BASE CURRENTS



FALL TIME vs TURN ON AND TURN OFF BASE CURRENTS



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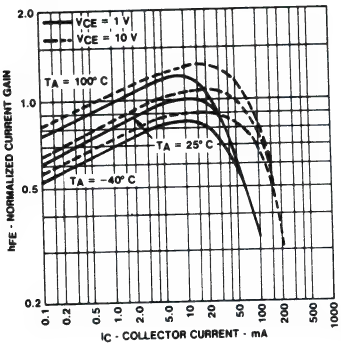
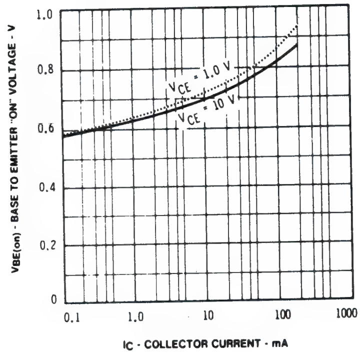
Curve Set number T144

Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

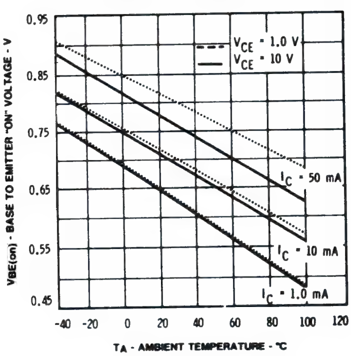
NORMALIZED CURRENT GAIN vs COLLECTOR CURRENT



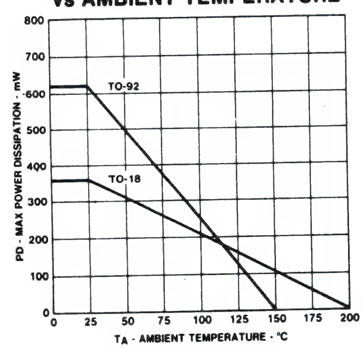
BASE TO EMITTER "ON" VOLTAGE vs COLLECTOR CURRENT



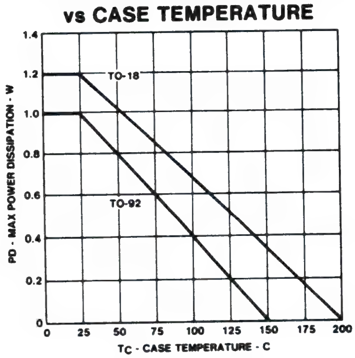
BASE TO EMITTER "ON" VOLTAGE vs AMBIENT TEMPERATURE



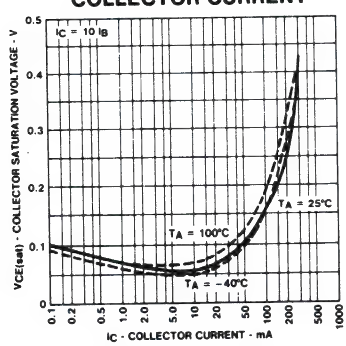
MAXIMUM POWER DISSIPATION vs AMBIENT TEMPERATURE



MAXIMUM POWER DISSIPATION vs CASE TEMPERATURE

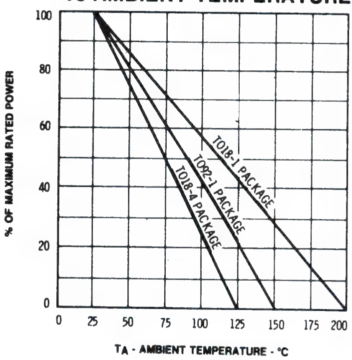


COLLECTOR SATURATION VOLTAGE vs COLLECTOR CURRENT

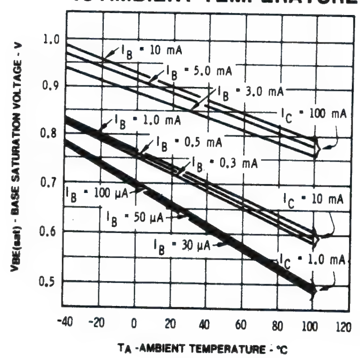


Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

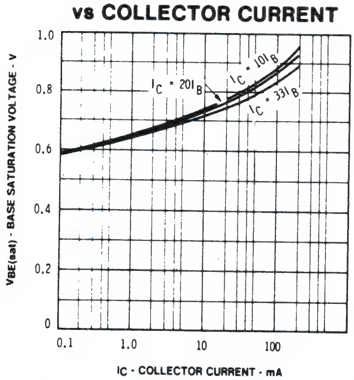
ALLOWABLE POWER DISSIPATION vs AMBIENT TEMPERATURE



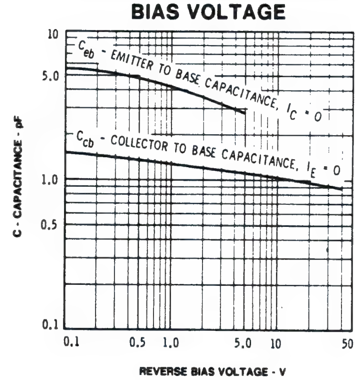
BASE SATURATION VOLTAGE vs AMBIENT TEMPERATURE



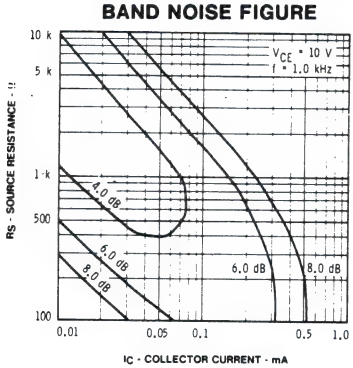
BASE SATURATION VOLTAGE vs COLLECTOR CURRENT



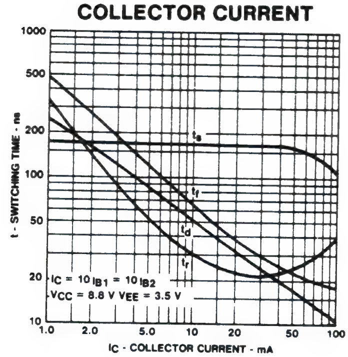
CAPACITANCE vs REVERSE BIAS VOLTAGE



CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



SWITCHING TIME vs COLLECTOR CURRENT



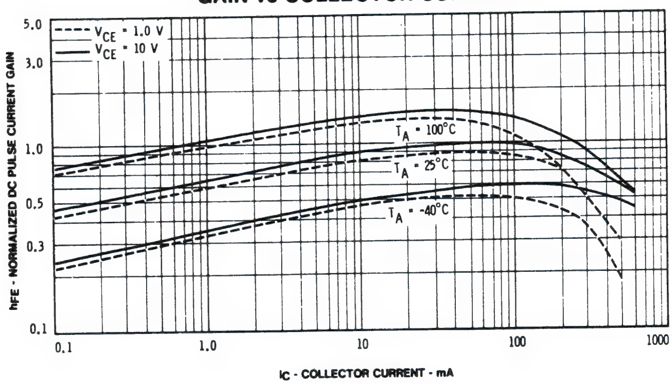
FAIRCHILD

A Schlumberger Company

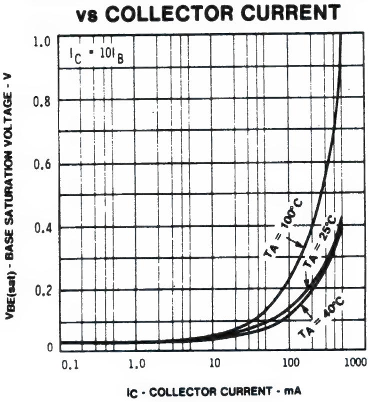
Curve Set number T145

Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

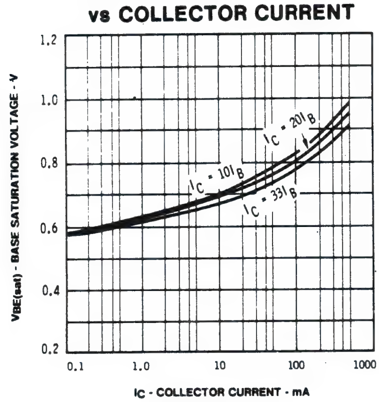
NORMALIZED DC PULSE CURRENT GAIN vs COLLECTOR CURRENT



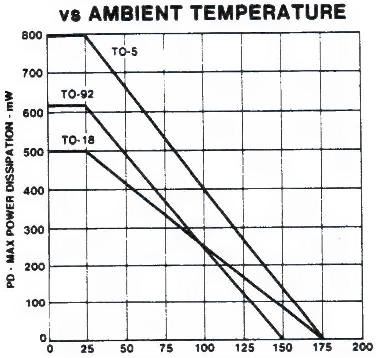
COLLECTOR SATURATION VOLTAGE vs COLLECTOR CURRENT



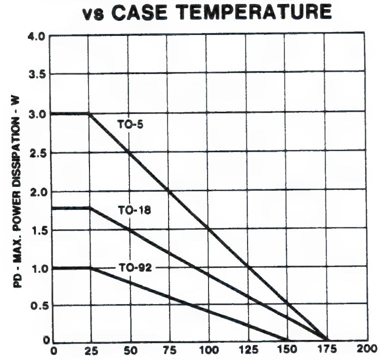
BASE SATURATION VOLTAGE vs COLLECTOR CURRENT



MAXIMUM POWER DISSIPATION vs AMBIENT TEMPERATURE



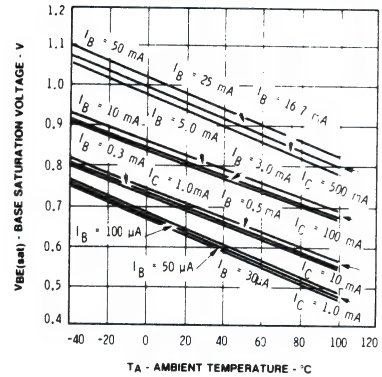
MAXIMUM POWER DISSIPATION vs CASE TEMPERATURE



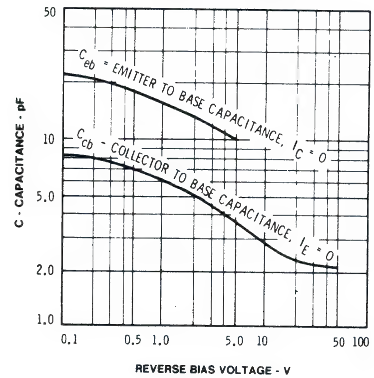
Curve Set number T145

Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

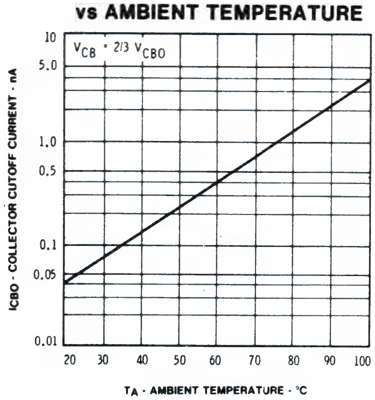
BASE SATURATION VOLTAGE vs AMBIENT TEMPERATURE



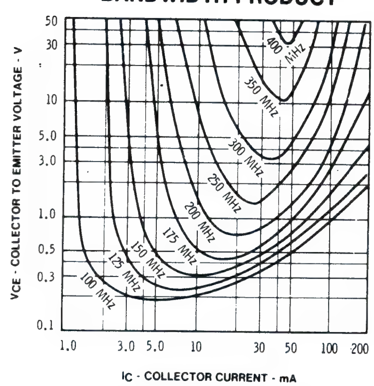
CAPACITANCE vs REVERSE BIAS VOLTAGE



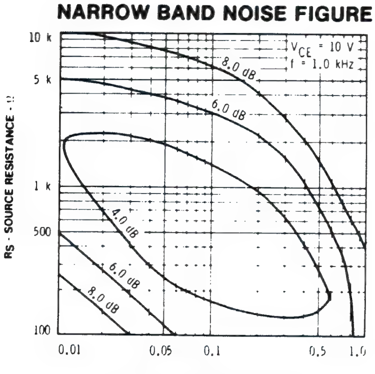
COLLECTOR CUTOFF CURRENT vs AMBIENT TEMPERATURE



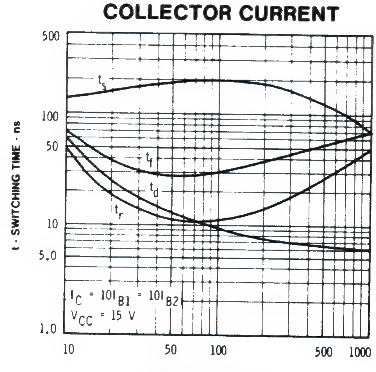
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT



CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



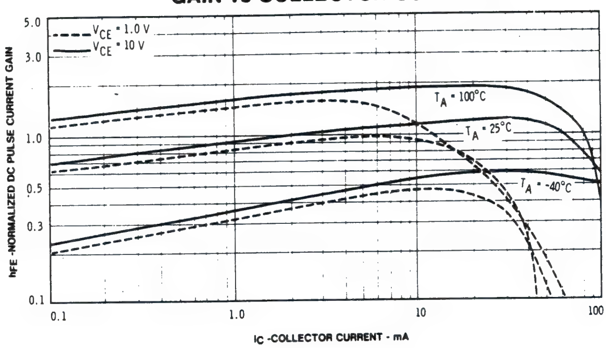
SWITCHING TIME VS COLLECTOR CURRENT



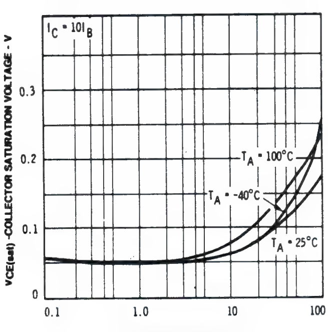
Curve Set number T147

Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

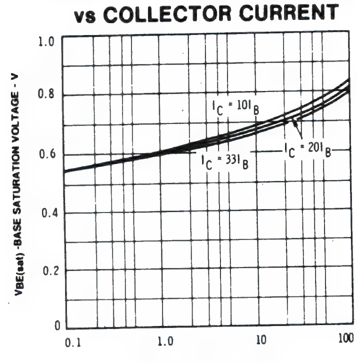
NORMALIZED DC PULSE CURRENT GAIN vs COLLECTOR CURRENT



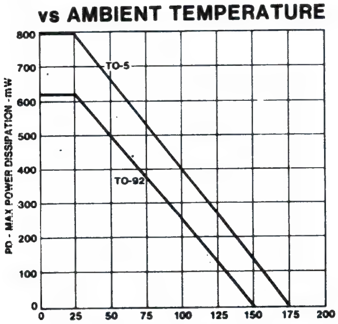
COLLECTOR SATURATION VOLTAGE vs COLLECTOR CURRENT



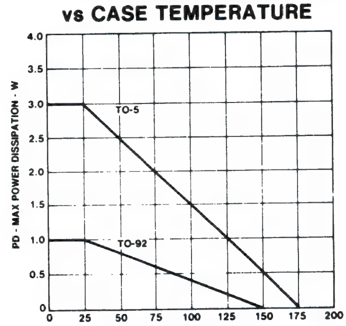
BASE SATURATION VOLTAGE vs COLLECTOR CURRENT



MAXIMUM POWER DISSIPATION vs AMBIENT TEMPERATURE



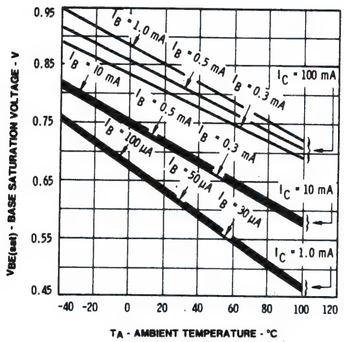
MAXIMUM POWER DISSIPATION vs CASE TEMPERATURE



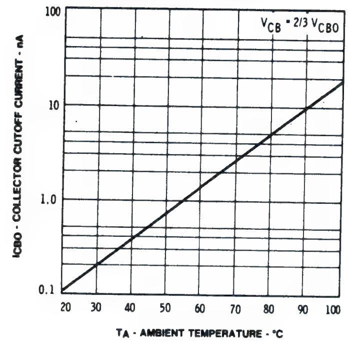
Curve Set number T147

Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

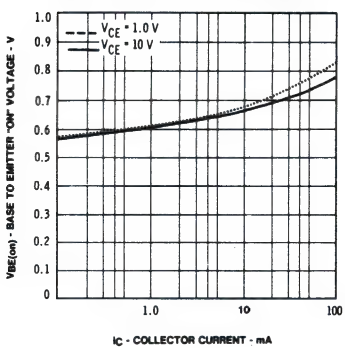
BASE SATURATION VOLTAGE vs AMBIENT TEMPERATURE



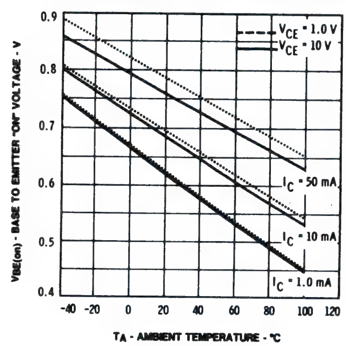
COLLECTOR CUTOFF CURRENT vs AMBIENT TEMPERATURE



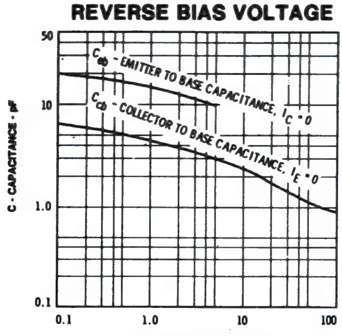
BASE TO EMITTER "ON" VOLTAGE vs COLLECTOR CURRENT



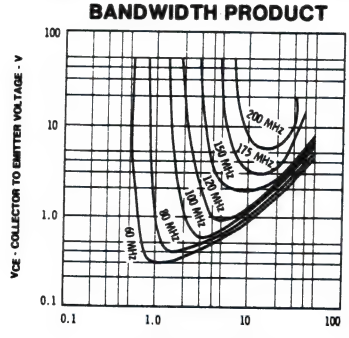
BASE TO EMITTER "ON" VOLTAGE vs AMBIENT TEMPERATURE



CAPACITANCE VS REVERSE BIAS VOLTAGE



CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT

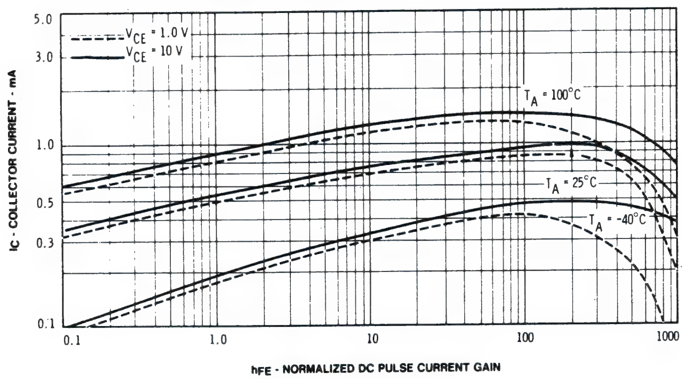


FAIRCHILD
A Schlumberger Company

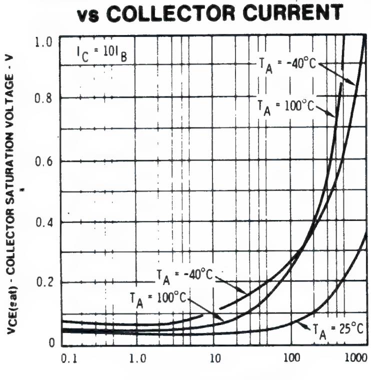
Curve Set number T149

Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

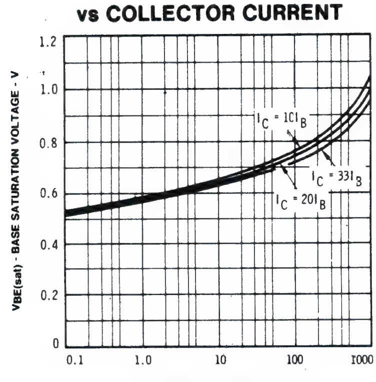
NORMALIZED DC PULSE CURRENT GAIN vs COLLECTOR CURRENT



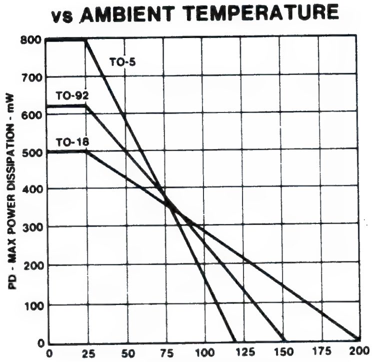
COLLECTOR SATURATION VOLTAGE vs COLLECTOR CURRENT



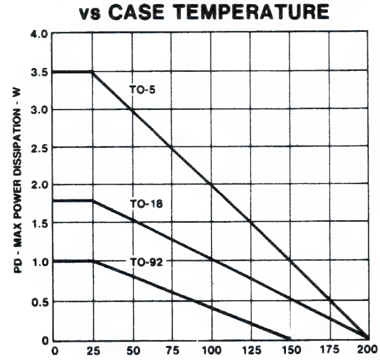
BASE SATURATION VOLTAGE vs COLLECTOR CURRENT



MAXIMUM POWER DISSIPATION vs AMBIENT TEMPERATURE

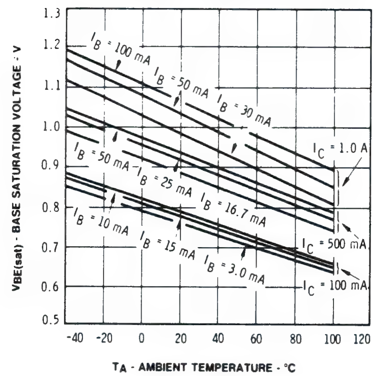


MAXIMUM POWER DISSIPATION vs CASE TEMPERATURE

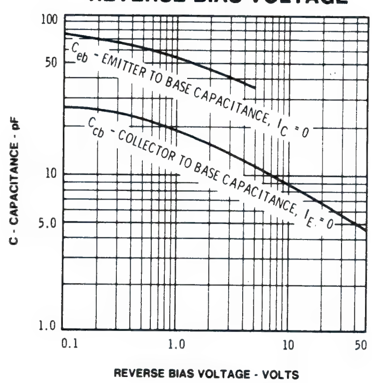


Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

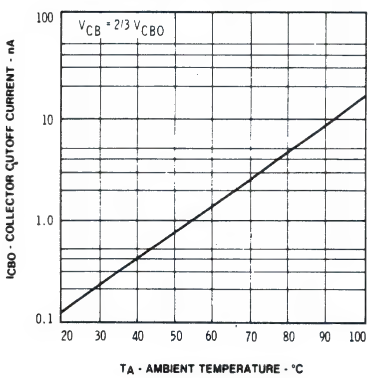
BASE SATURATION VOLTAGE vs AMBIENT TEMPERATURE



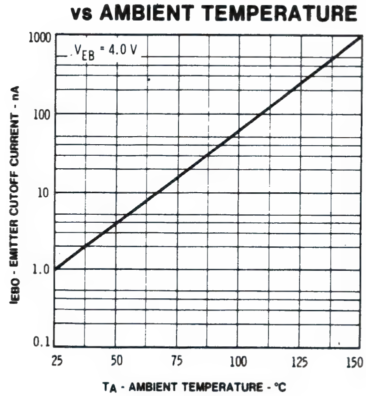
CAPACITANCE vs REVERSE BIAS VOLTAGE



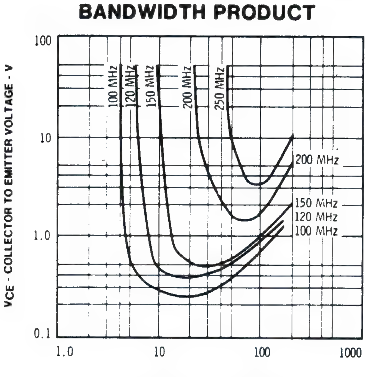
COLLECTOR CUTOFF CURRENT vs AMBIENT TEMPERATURE



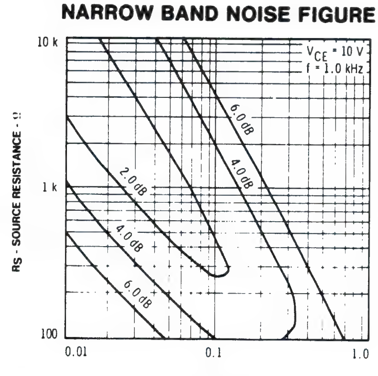
EMITTER CUTOFF CURRENT vs AMBIENT TEMPERATURE



CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT



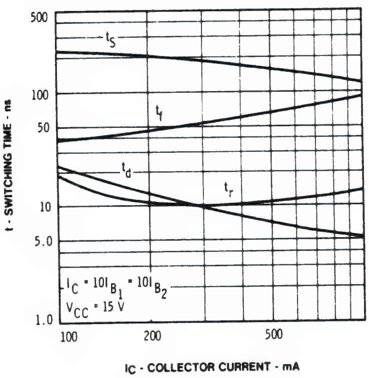
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



Curve Set number T149

Typical Electrical Characteristic Curves
25° C Ambient Temperature unless otherwise noted

SWITCHING TIME vs COLLECTOR CURRENT

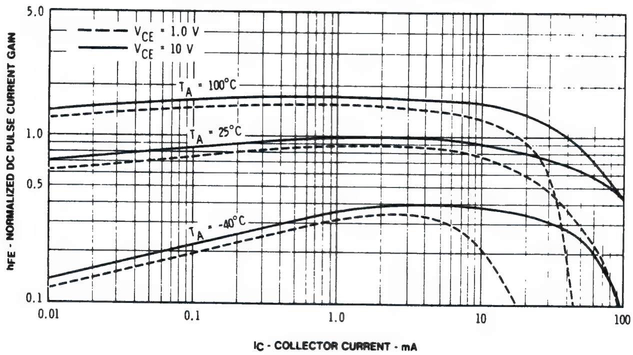


FAIRCHILD
A Schlumberger Company

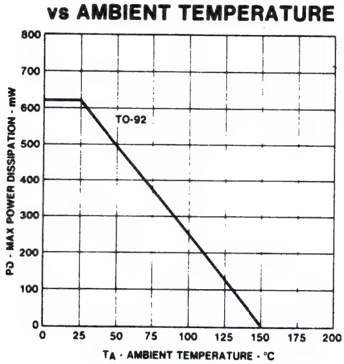
Curve Set number T155

Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

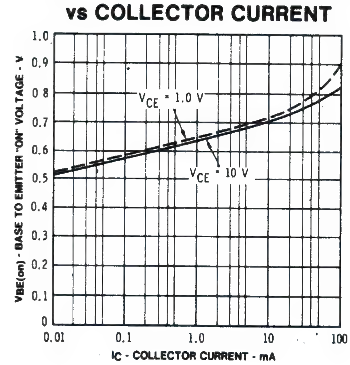
NORMALIZED DC PULSE CURRENT GAIN vs COLLECTOR CURRENT



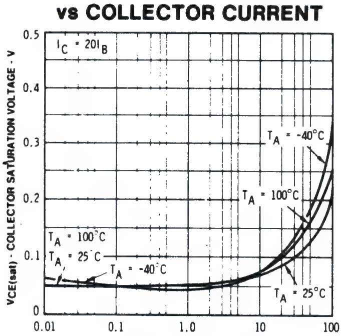
MAXIMUM POWER DISSIPATION vs AMBIENT TEMPERATURE



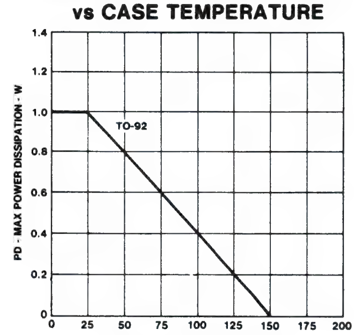
BASE EMITTER "ON" VOLTAGE vs COLLECTOR CURRENT



COLLECTOR SATURATION VOLTAGE vs COLLECTOR CURRENT



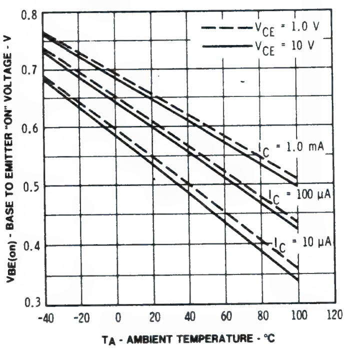
MAXIMUM POWER DISSIPATION vs CASE TEMPERATURE



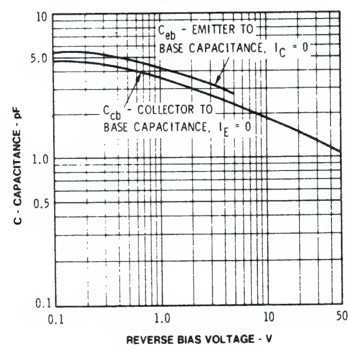
4

Typical Electrical Characteristic Curves
25° C Ambient Temperature unless otherwise noted

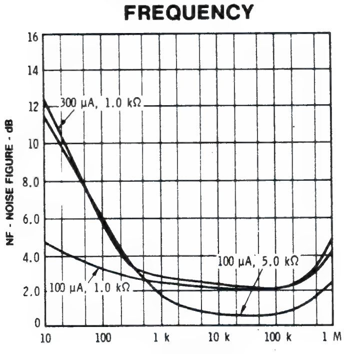
BASE TO EMITTER 'ON' VOLTAGE vs AMBIENT TEMPERATURE



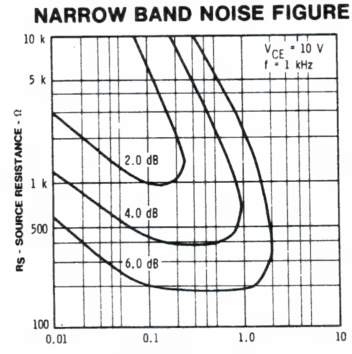
CAPACITANCE vs REVERSE BIAS VOLTAGE



NOISE FIGURE vs FREQUENCY



CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



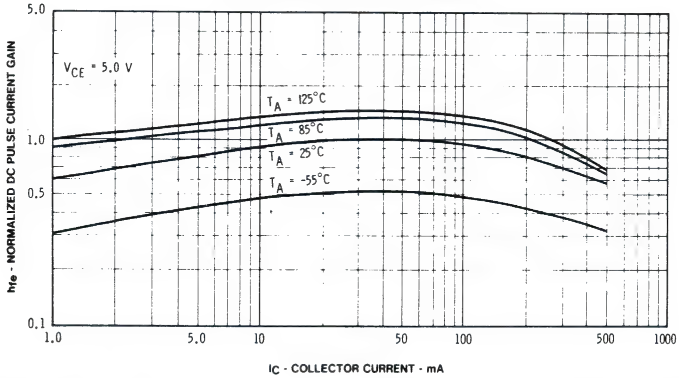
FAIRCHILD

A Schlumberger Company

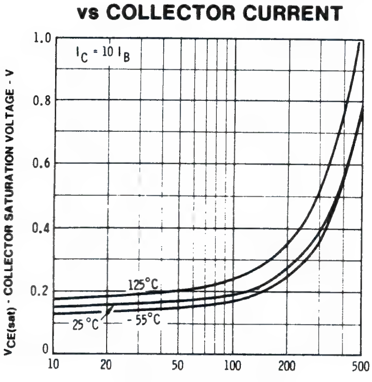
Curve Set number T162

Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

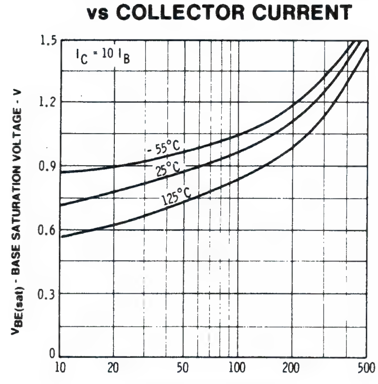
NORMALIZED CURRENT GAIN vs COLLECTOR CURRENT



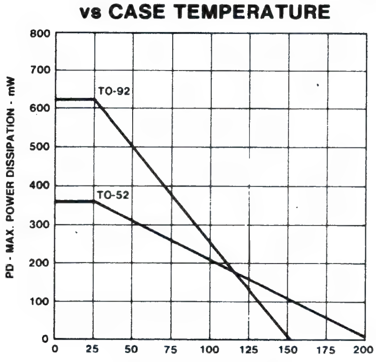
COLLECTOR SATURATION VOLTAGE vs COLLECTOR CURRENT



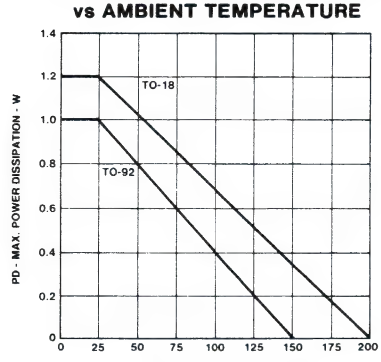
BASE SATURATION VOLTAGE vs COLLECTOR CURRENT



MAXIMUM POWER DISSIPATION vs CASE TEMPERATURE



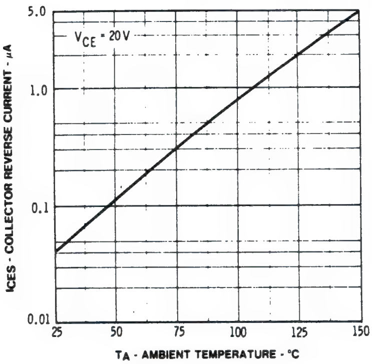
MAXIMUM POWER DISSIPATION vs AMBIENT TEMPERATURE



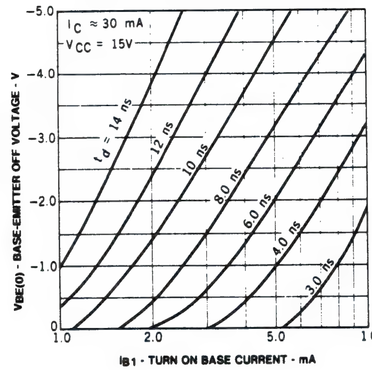
4

Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

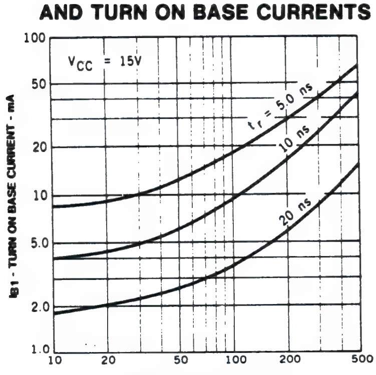
COLLECTOR REVERSE CURRENT vs AMBIENT TEMPERATURE



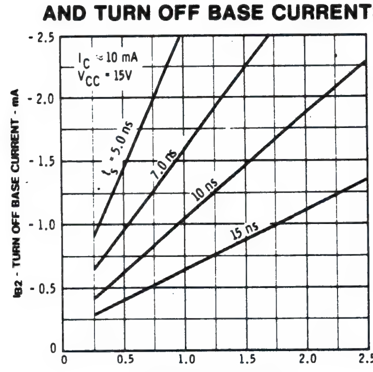
DELAY TIME vs BASE EMITTER OFF VOLTAGE AND TURN ON BASE CURRENT



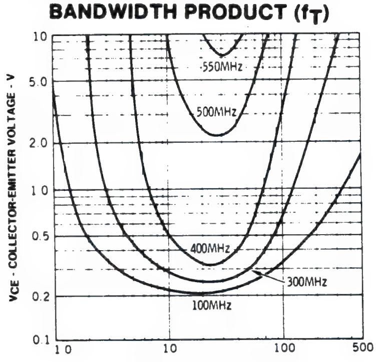
RISE TIME vs COLLECTOR AND TURN ON BASE CURRENTS



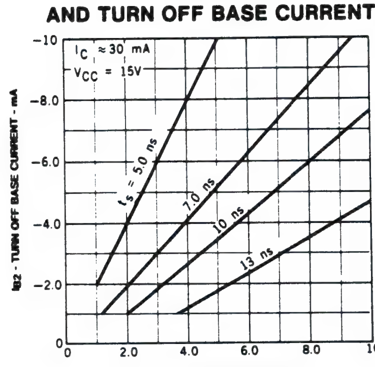
STORAGE TIME vs TURN ON AND TURN OFF BASE CURRENTS



CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT (f_T)

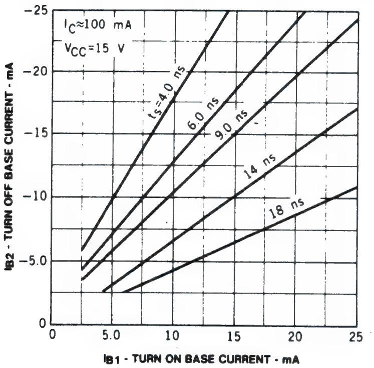


STORAGE TIME vs TURN ON AND TURN OFF BASE CURRENTS

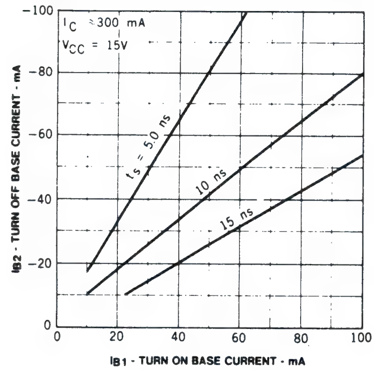


Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

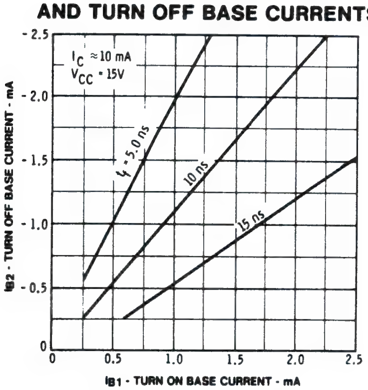
STORAGE TIME vs TURN ON AND TURN OFF BASE CURRENTS



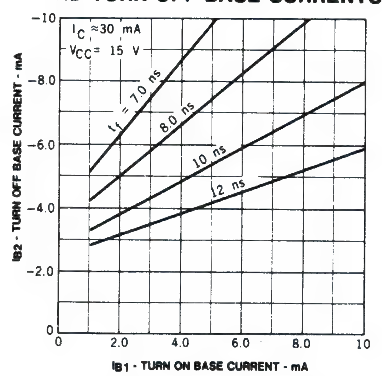
STORAGE TIME vs TURN ON AND TURN OFF BASE CURRENTS



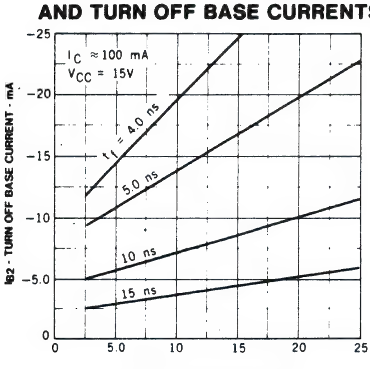
FALL TIME vs TURN ON AND TURN OFF BASE CURRENTS



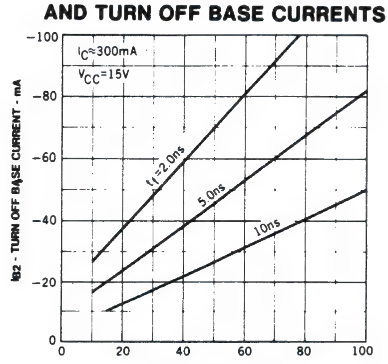
FALL TIME vs TURN ON AND TURN OFF BASE CURRENTS



FALL TIME vs TURN ON AND TURN OFF BASE CURRENTS



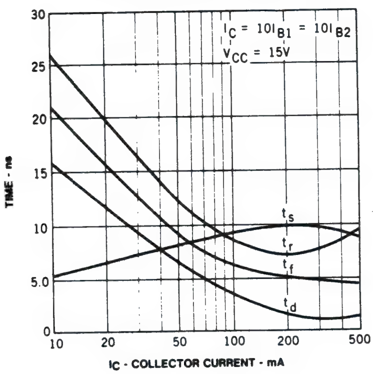
FALL TIME vs TURN ON AND TURN OFF BASE CURRENTS



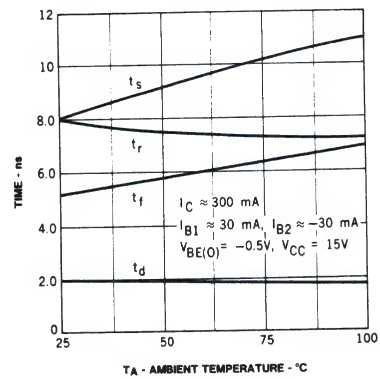
Curve Set number T162

Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

SWITCHING TIMES vs COLLECTOR CURRENT



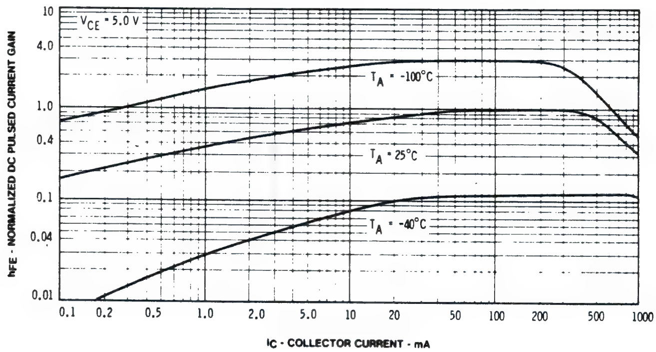
SWITCHING TIMES vs AMBIENT TEMPERATURE



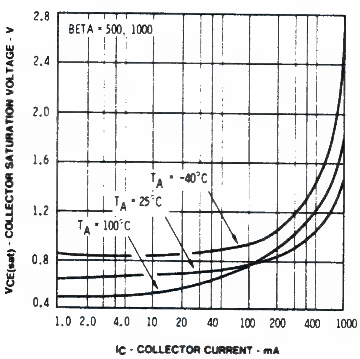
Curve Set number T164

Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

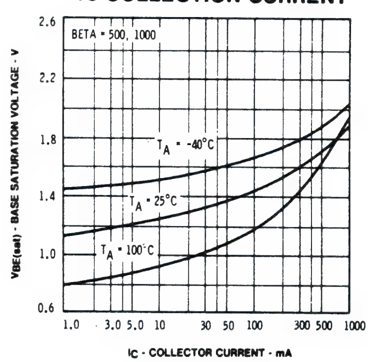
NORMALIZED DC PULSED CURRENT GAIN vs COLLECTOR CURRENT



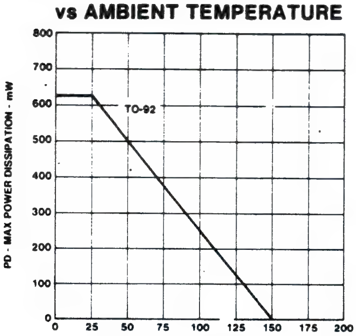
COLLECTOR SATURATION VOLTAGE vs COLLECTOR CURRENT



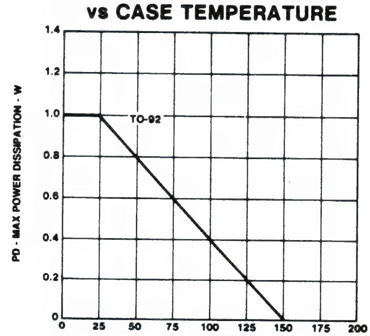
BASE SATURATION VOLTAGE vs COLLECTION CURRENT



MAXIMUM POWER DISSIPATION vs AMBIENT TEMPERATURE

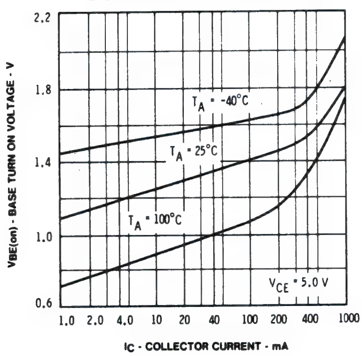


MAXIMUM POWER DISSIPATION vs CASE TEMPERATURE



Typical Electrical Characteristic Curves
25° C Ambient Temperature unless otherwise noted

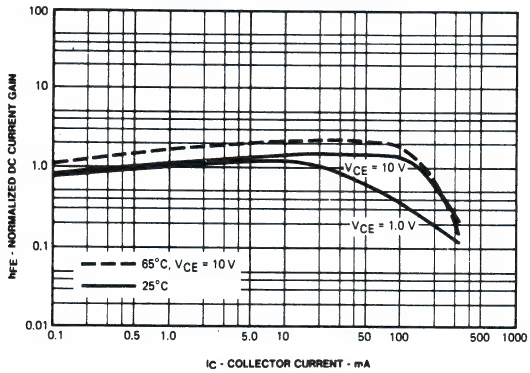
BASE TURN ON VOLTAGE vs COLLECTOR CURRENT



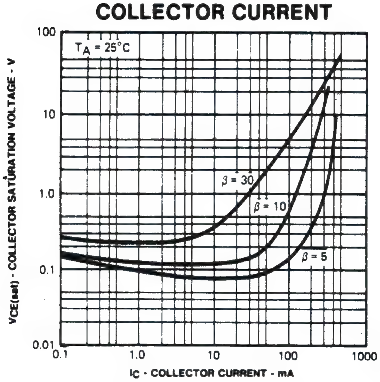
Curve Set number T176

Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

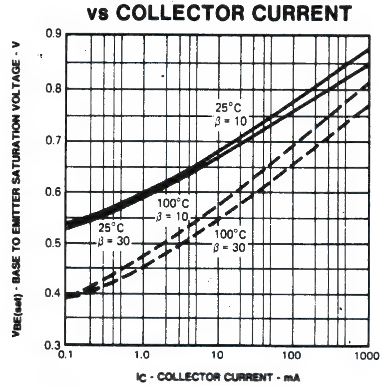
NORMALIZED DC CURRENT GAIN vs COLLECTOR CURRENT



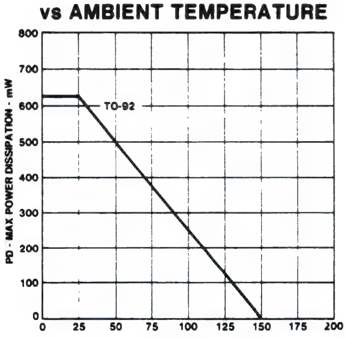
COLLECTOR SATURATION VOLTAGE vs COLLECTOR CURRENT



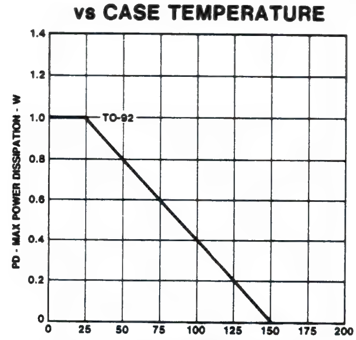
BASE TO EMITTER SATURATION VOLTAGE vs COLLECTOR CURRENT



MAXIMUM POWER DISSIPATION vs AMBIENT TEMPERATURE



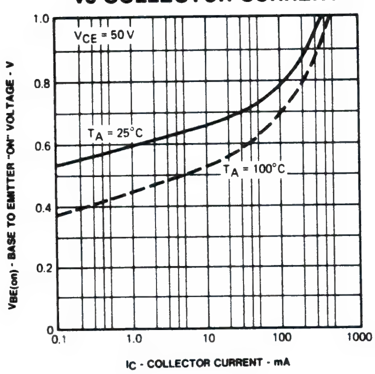
MAXIMUM POWER DISSIPATION vs CASE TEMPERATURE



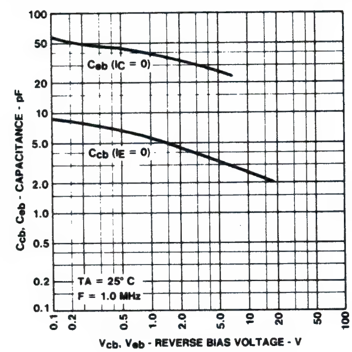
Curve Set number T176

Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

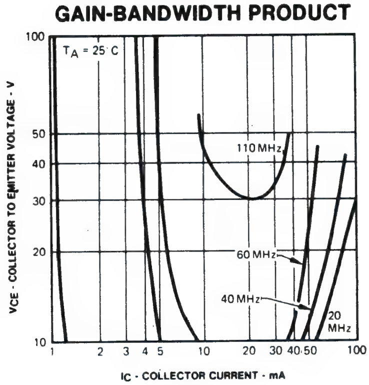
BASE TO EMITTER "ON" VOLTAGE vs COLLECTOR CURRENT



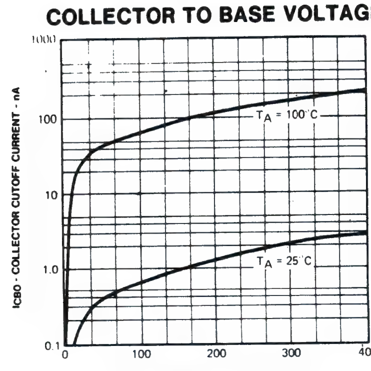
C_{CB} AND C_{EB} vs COLLECTOR TO BASE REVERSE BIAS VOLTAGE



CONTOURS OF CONSTANT GAIN-BANDWIDTH PRODUCT

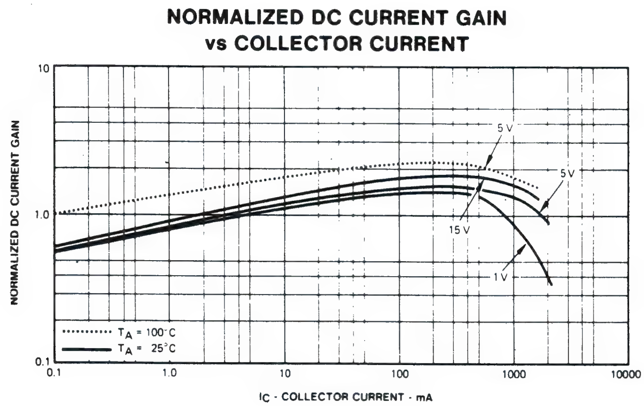


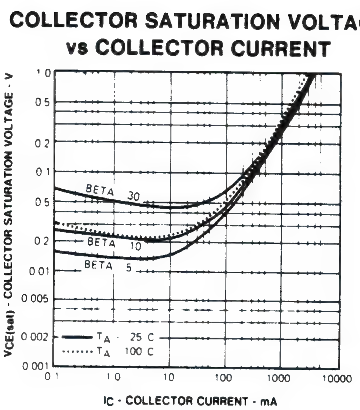
COLLECTOR CUTOFF CURRENT vs COLLECTOR TO BASE VOLTAGE

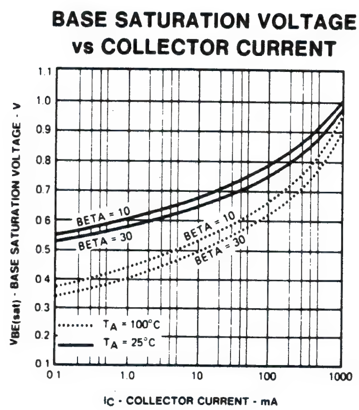


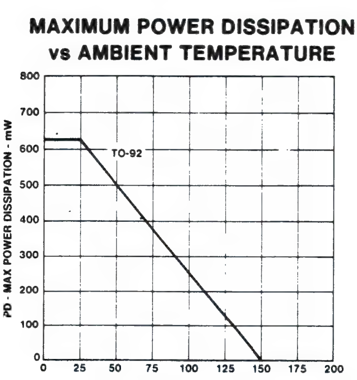
Curve Set number T202

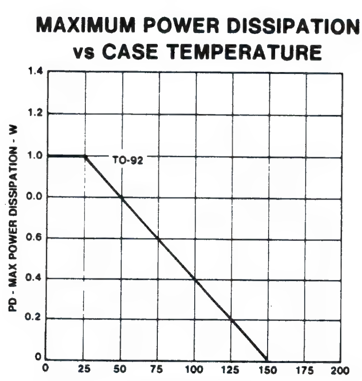
Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted









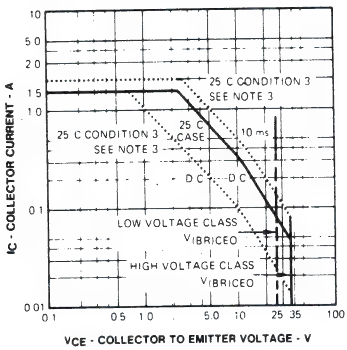


Curve Set number T202

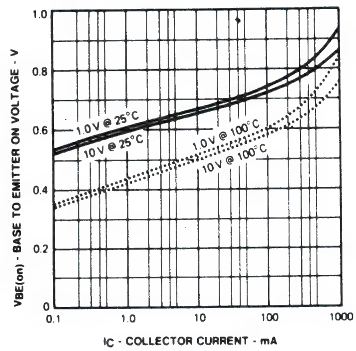
Typical Electrical Characteristic Curves

25° C Ambient Temperature unless otherwise noted

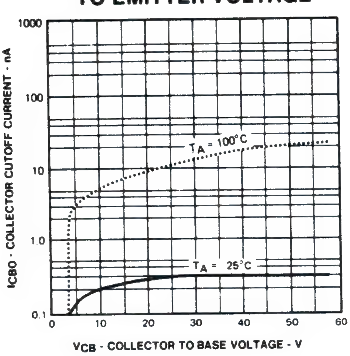
SAFE OPERATING AREA



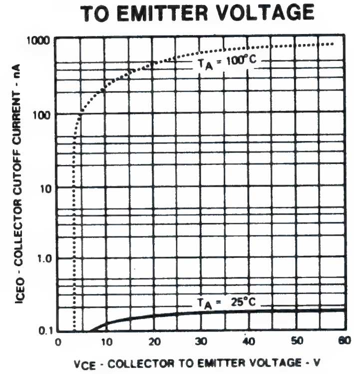
BASE TO EMITTER ON VOLTAGE vs COLLECTOR CURRENT



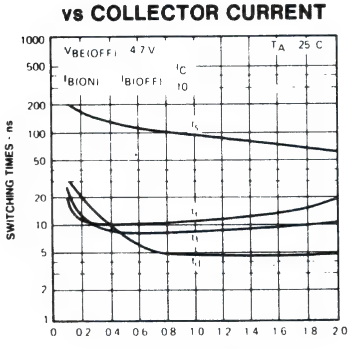
COLLECTOR CUTOFF CURRENT vs COLLECTOR TO EMITTER VOLTAGE



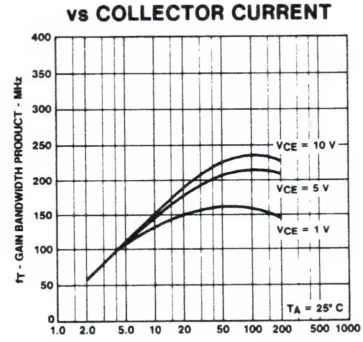
COLLECTOR CUTOFF CURRENT vs COLLECTOR TO EMITTER VOLTAGE



SWITCHING TIMES vs COLLECTOR CURRENT

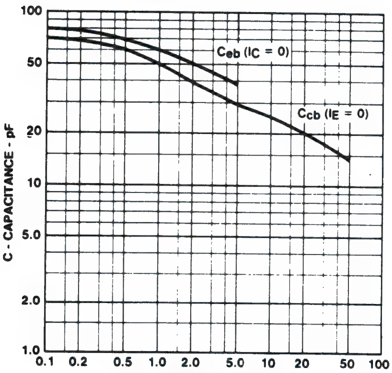


GAIN BANDWIDTH PRODUCT vs COLLECTOR CURRENT



Typical Electrical Characteristic Curves
25° C Ambient Temperature unless otherwise noted

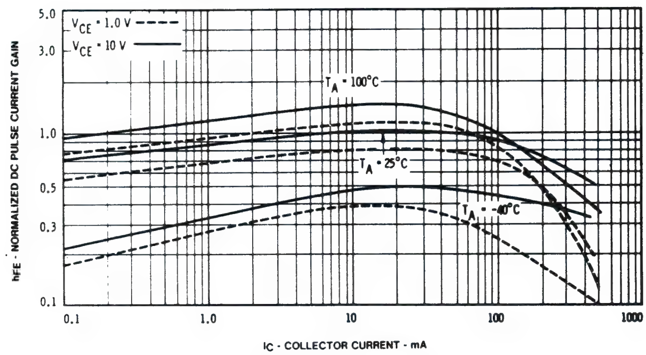
CAPACITANCE vs REVERSE BIAS VOLTAGE



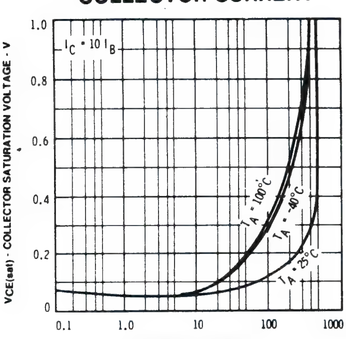
Curve Set number T212

Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

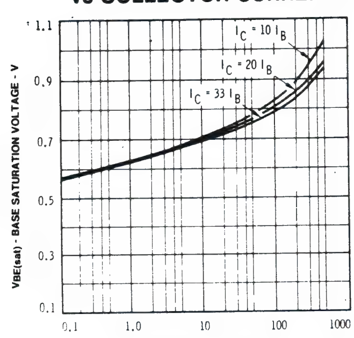
NORMALIZED DC PULSE CURRENT GAIN vs COLLECTOR CURRENT



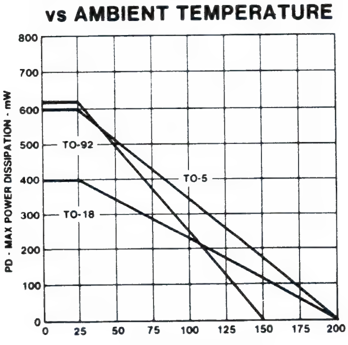
COLLECTOR SATURATION VOLTAGE vs COLLECTOR CURRENT



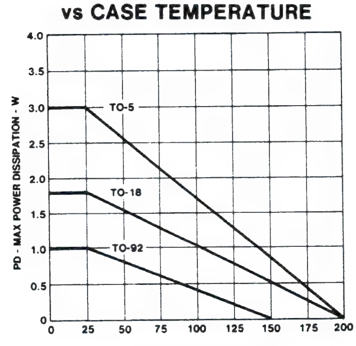
BASE SATURATION VOLTAGE vs COLLECTOR CURRENT



MAXIMUM POWER DISSIPATION vs AMBIENT TEMPERATURE



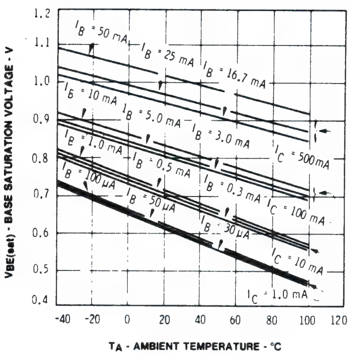
MAXIMUM POWER DISSIPATION vs CASE TEMPERATURE



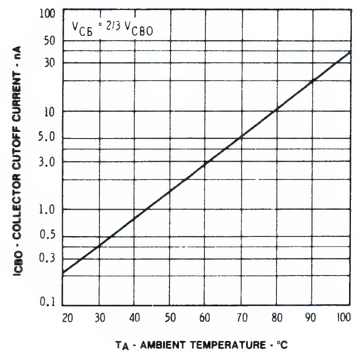
Curve Set number T212

Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

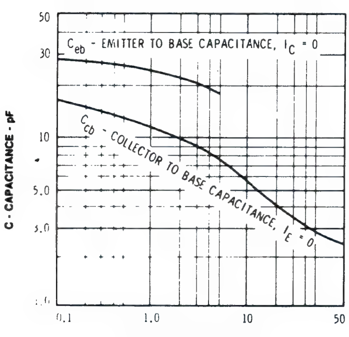
BASE SATURATION VOLTAGE vs AMBIENT TEMPERATURE



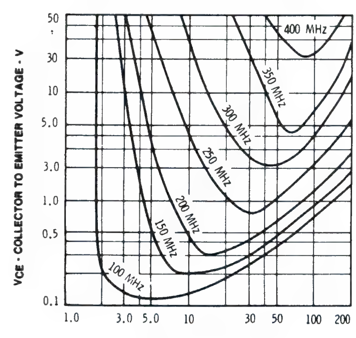
COLLECTOR CUTOFF CURRENT vs AMBIENT TEMPERATURE



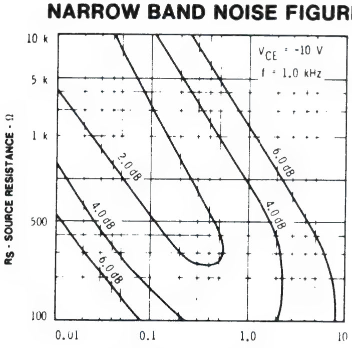
CAPACITANCE vs REVERSE BIAS VOLTAGE



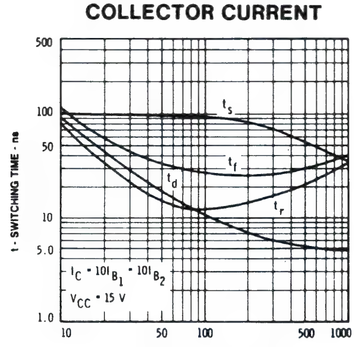
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT



CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



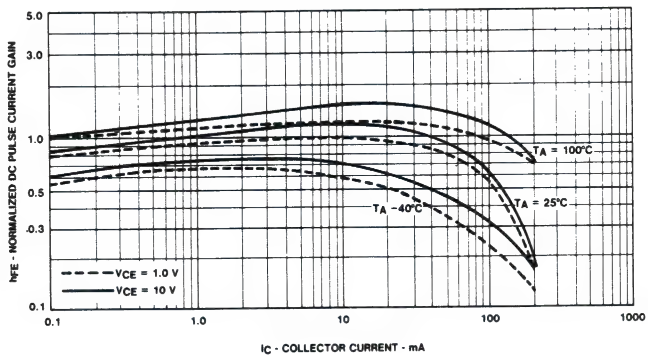
SWITCHING TIME vs COLLECTOR CURRENT



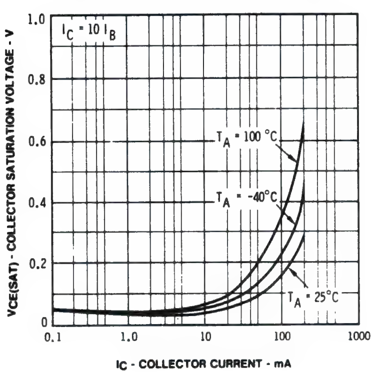
Curve Set number T215

Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

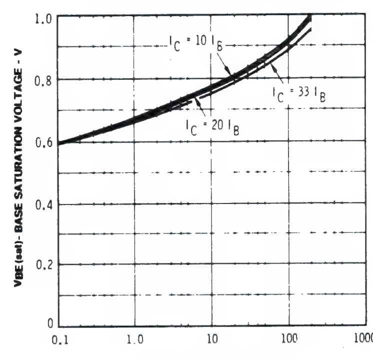
NORMALIZED DC PULSE CURRENT GAIN vs COLLECTOR CURRENT



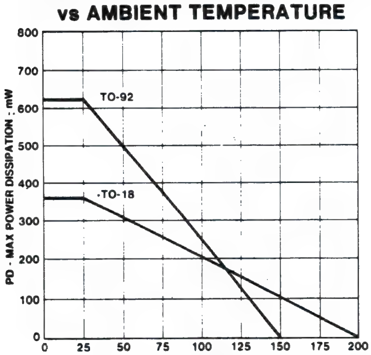
COLLECTOR SATURATION VOLTAGE vs COLLECTOR CURRENT



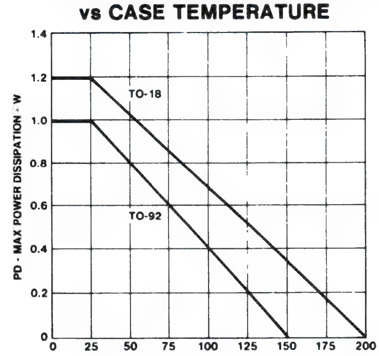
BASE SATURATION VOLTAGE vs COLLECTOR CURRENT



MAXIMUM POWER DISSIPATION vs AMBIENT TEMPERATURE



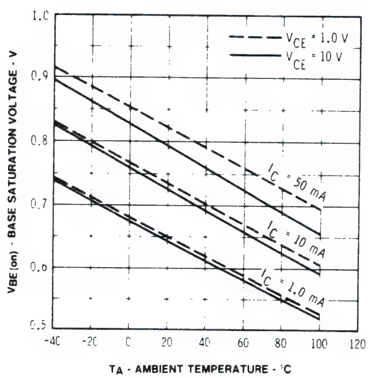
MAXIMUM POWER DISSIPATION vs CASE TEMPERATURE



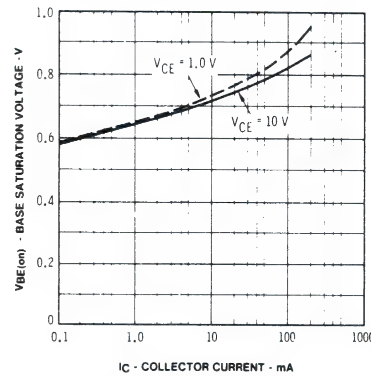
Curve Set number T215

Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

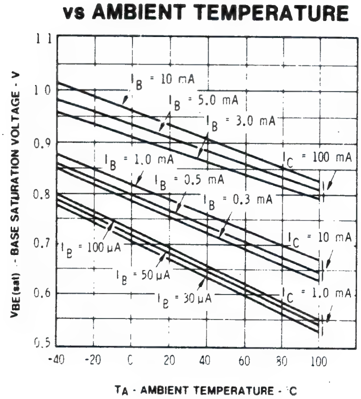
BASE TO EMITTER 'ON' VOLTAGE vs AMBIENT TEMPERATURE



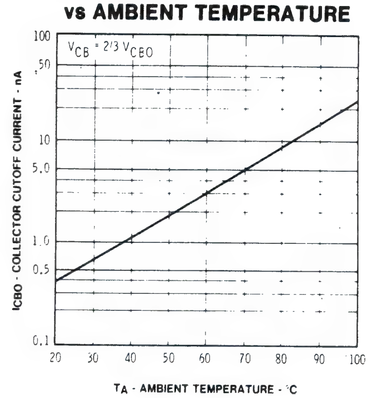
BASE TO EMITTER 'ON' VOLTAGE vs COLLECTOR CURRENT



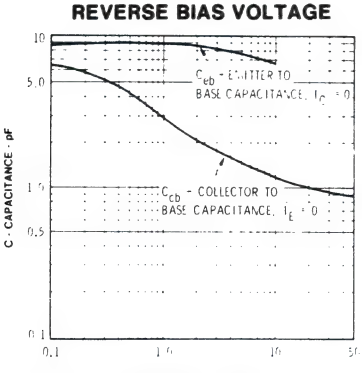
BASE SATURATION VOLTAGE vs AMBIENT TEMPERATURE



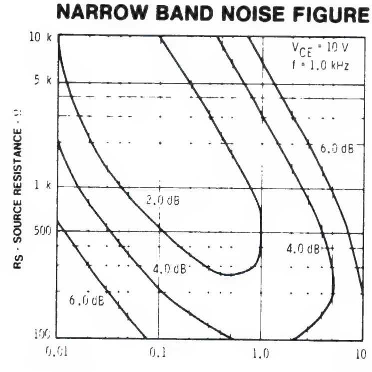
COLLECTOR CUTOFF CURRENT vs AMBIENT TEMPERATURE



CAPACITANCE vs REVERSE BIAS VOLTAGE



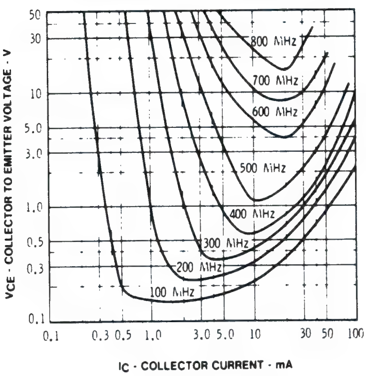
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



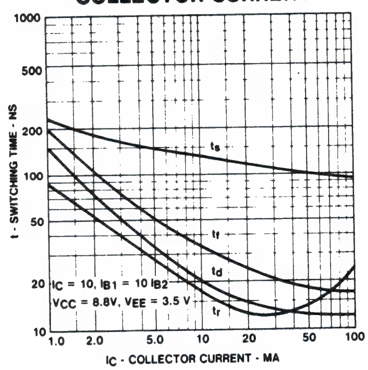
Curve Set number T215

Typical Electrical Characteristic Curves
25° C Ambient Temperature unless otherwise noted

CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT



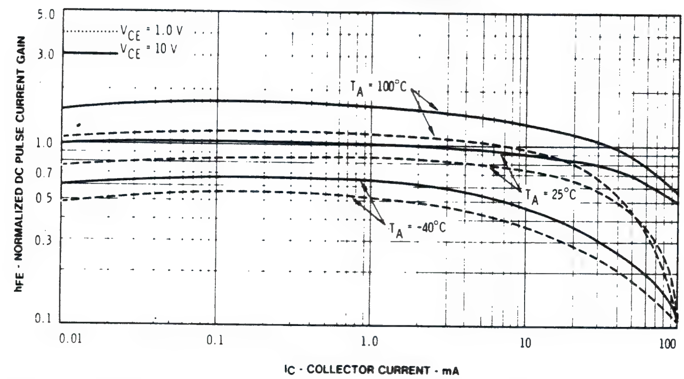
SWITCHING TIME vs COLLECTOR CURRENT



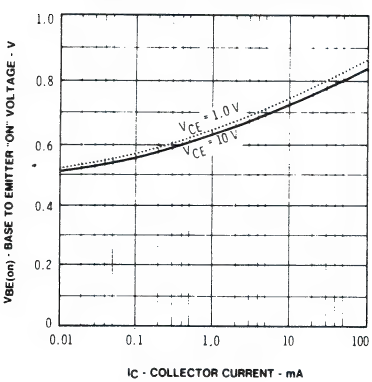
Curve Set number T219

Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

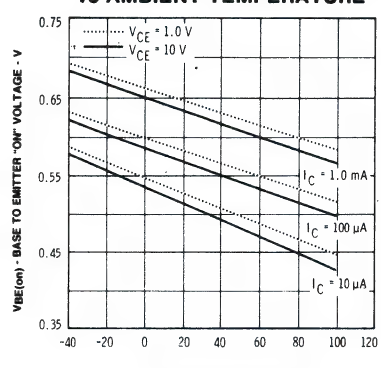
DC PULSE CURRENT GAIN vs COLLECTOR CURRENT



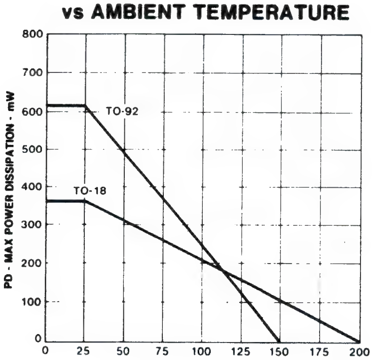
BASE TO EMITTER 'ON' VOLTAGE vs COLLECTOR CURRENT



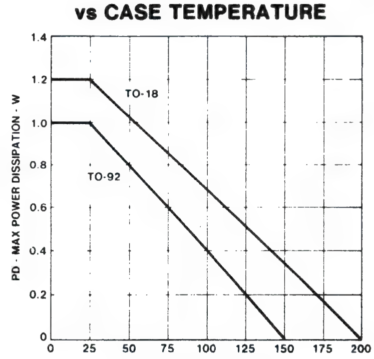
BASE TO EMITTER 'ON' VOLTAGE vs AMBIENT TEMPERATURE



MAXIMUM POWER DISSIPATION vs AMBIENT TEMPERATURE



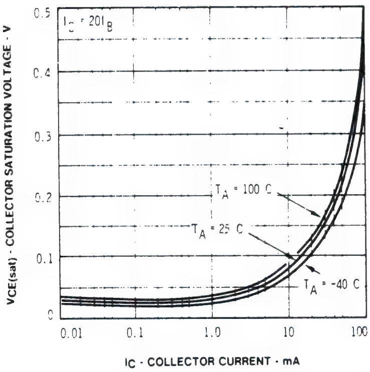
MAXIMUM POWER DISSIPATION vs CASE TEMPERATURE



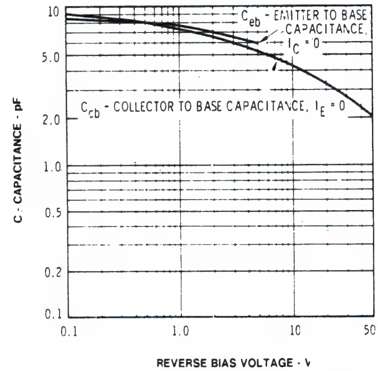
Curve Set number T219

Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

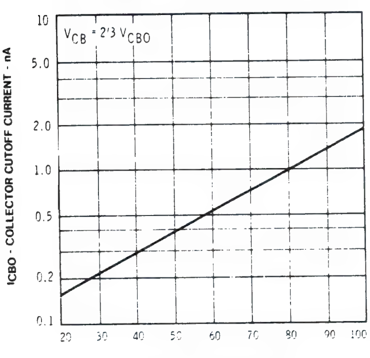
COLLECTOR SATURATION VOLTAGE vs COLLECTOR CURRENT



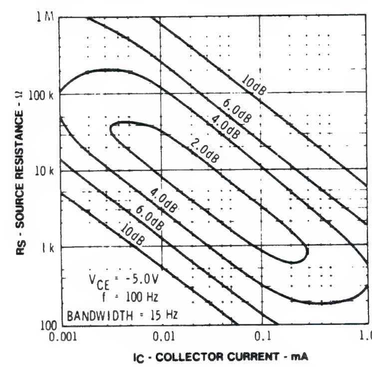
CAPACITANCE vs REVERSE BIAS VOLTAGE



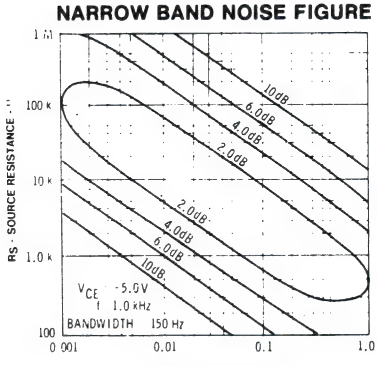
COLLECTOR CUTOFF CURRENT vs AMBIENT TEMPERATURE



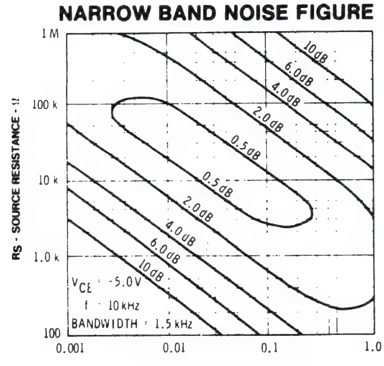
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE

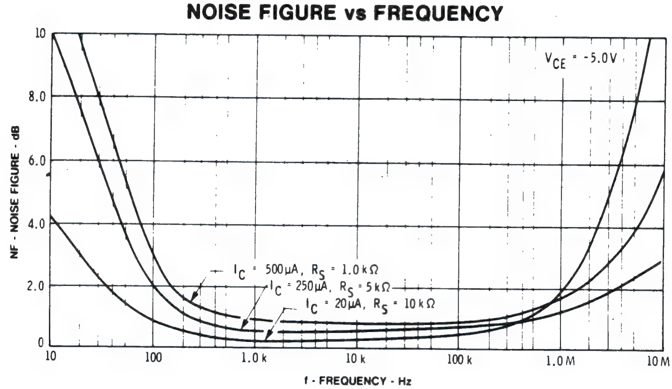


CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE

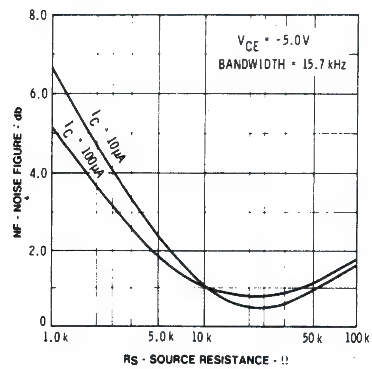


Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

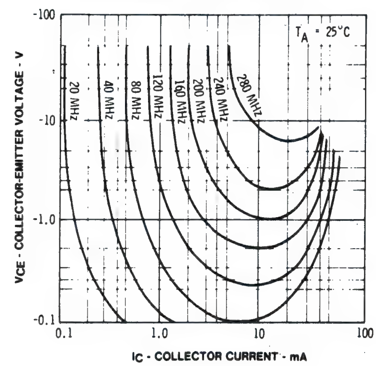
NOISE FIGURE vs FREQUENCY



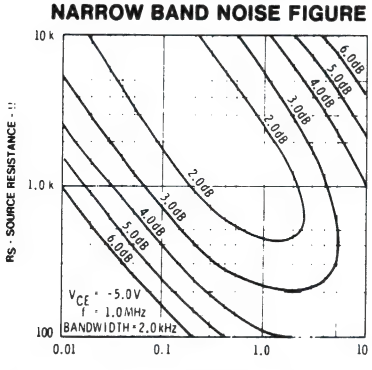
WIDE BAND NOISE FIGURE vs SOURCE RESISTANCE



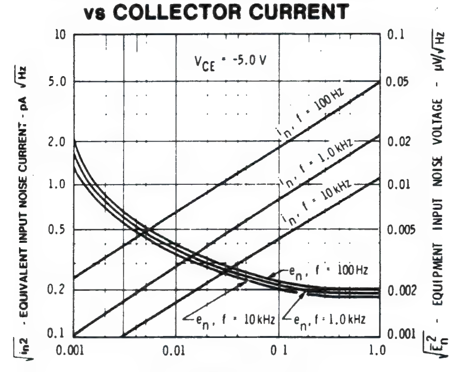
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT



CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



EQUIVALENT INPUT NOISE VOLTAGE AND NOISE CURRENT vs COLLECTOR CURRENT



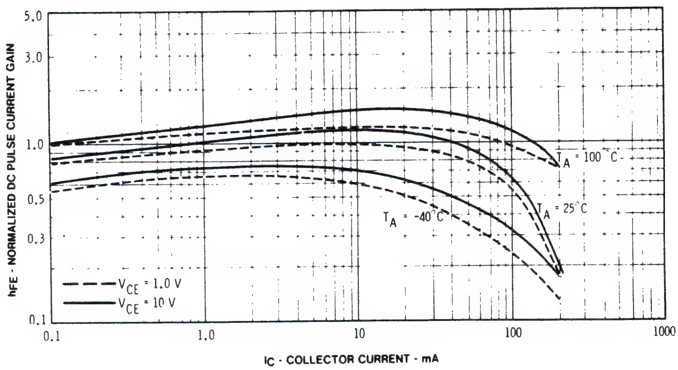
FAIRCHILD

A Schlumberger Company

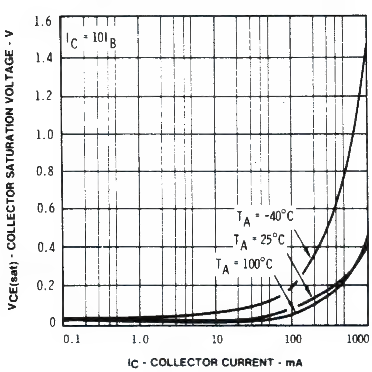
Curve Set number T224

Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

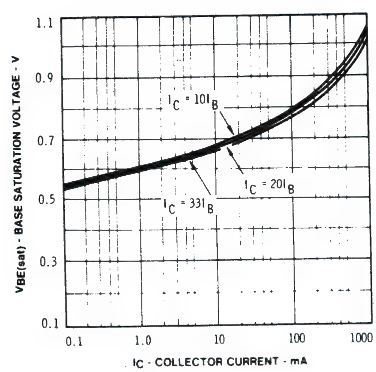
NORMALIZED DC PULSE CURRENT GAIN vs COLLECTOR CURRENT



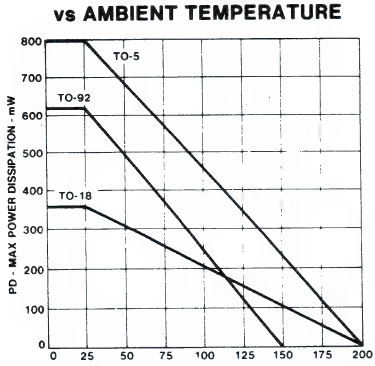
COLLECTOR SATURATION VOLTAGE vs COLLECTOR CURRENT



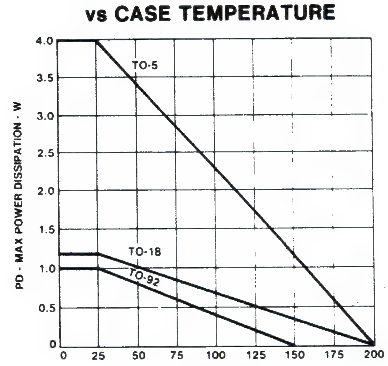
BASE SATURATION VOLTAGE vs COLLECTOR CURRENT



MAXIMUM POWER DISSIPATION vs AMBIENT TEMPERATURE



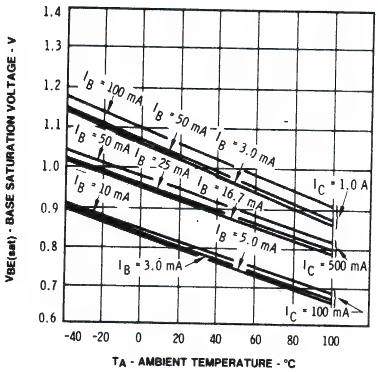
MAXIMUM POWER DISSIPATION vs CASE TEMPERATURE



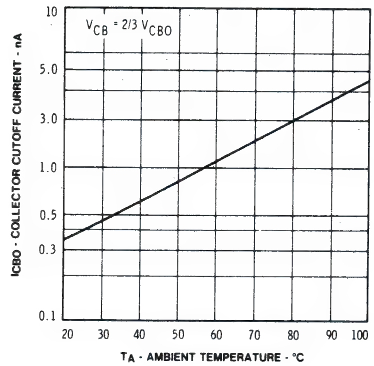
Curve Set number T224

Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

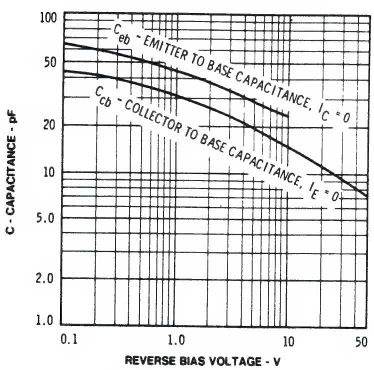
BASE SATURATION VOLTAGE vs AMBIENT TEMPERATURE



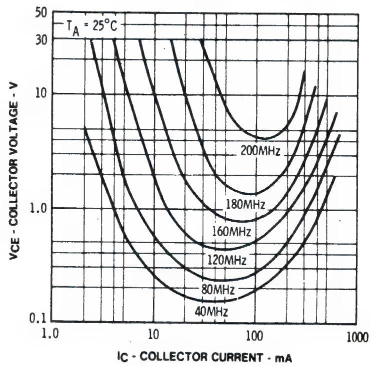
COLLECTOR CUTOFF CURRENT vs AMBIENT TEMPERATURE



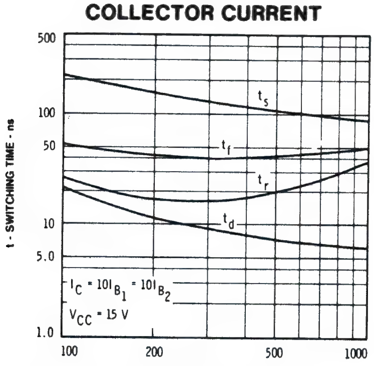
CAPACITANCE vs REVERSE BIAS VOLTAGE



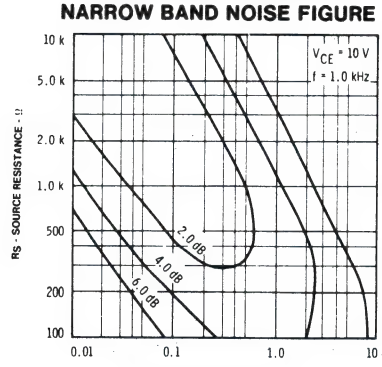
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT



SWITCHING TIME vs COLLECTOR CURRENT



CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE

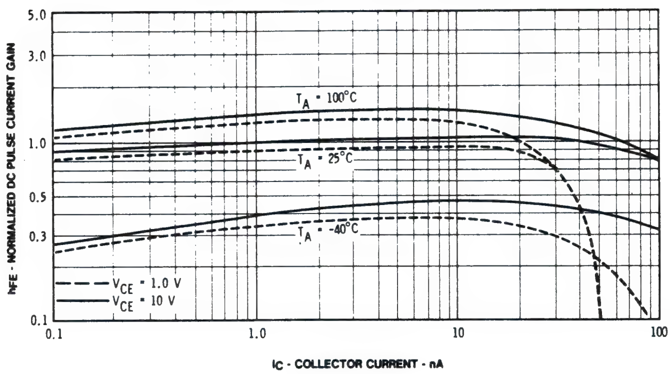


4

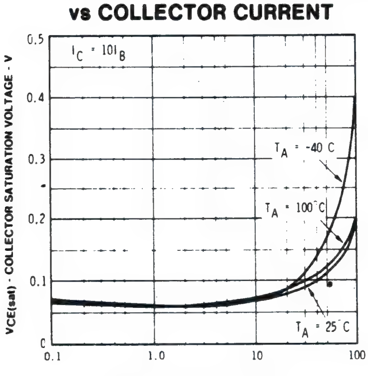
Curve Set number T232

Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

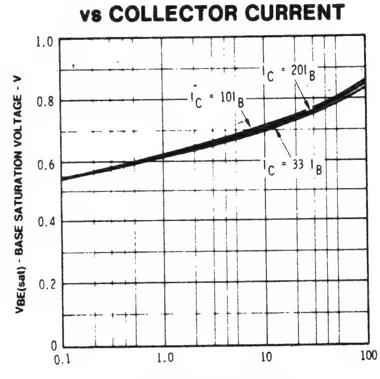
NORMALIZED DC PULSE CURRENT GAIN vs COLLECTOR CURRENT



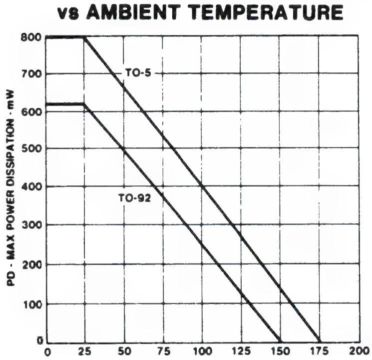
COLLECTOR SATURATION VOLTAGE vs COLLECTOR CURRENT



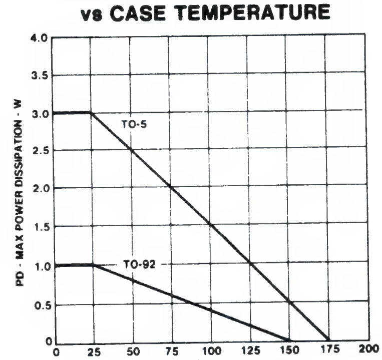
BASE SATURATION VOLTAGE vs COLLECTOR CURRENT



MAXIMUM POWER DISSIPATION vs AMBIENT TEMPERATURE



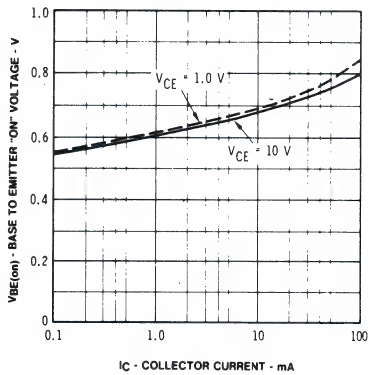
MAXIMUM POWER DISSIPATION vs CASE TEMPERATURE



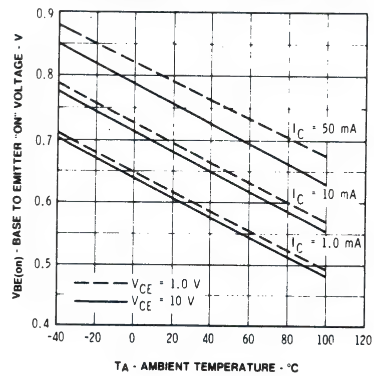
Curve Set number T232

Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

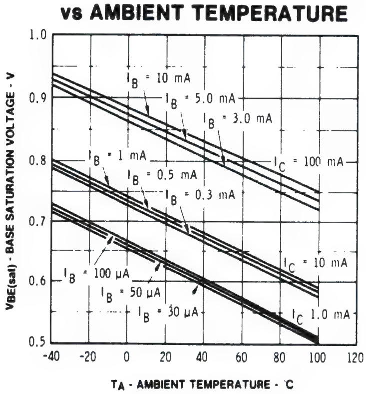
BASE TO EMITTER 'ON' VOLTAGE vs COLLECTOR CURRENT



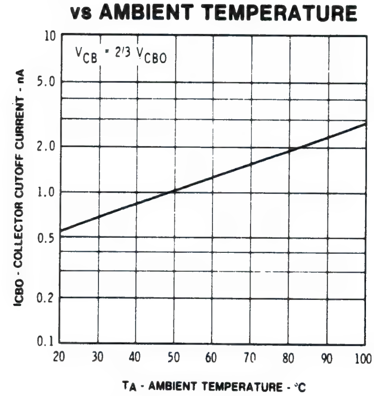
BASE TO EMITTER 'ON' VOLTAGE vs AMBIENT TEMPERATURE



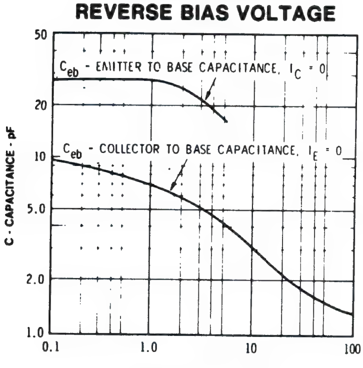
BASE SATURATION VOLTAGE vs AMBIENT TEMPERATURE



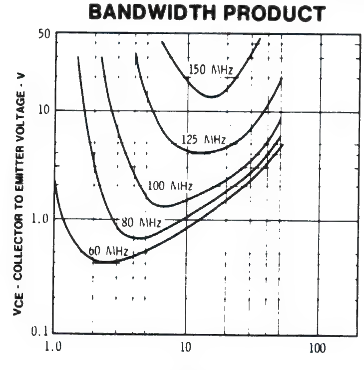
COLLECTOR CUTOFF CURRENT vs AMBIENT TEMPERATURE



CAPACITANCE vs REVERSE BIAS VOLTAGE



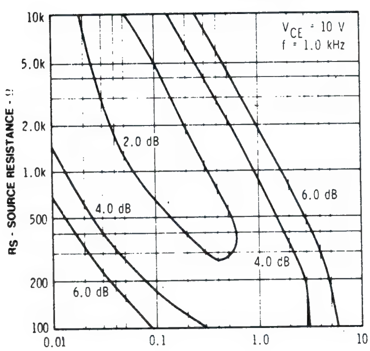
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT



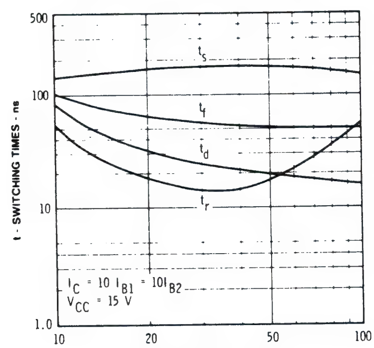
4

Typical Electrical Characteristic Curves
25° C Ambient Temperature unless otherwise noted

CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



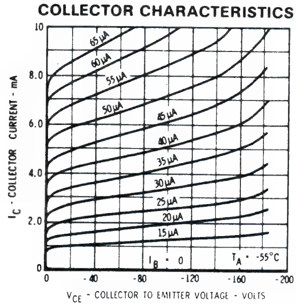
SWITCHING TIME vs COLLECTOR CURRENT



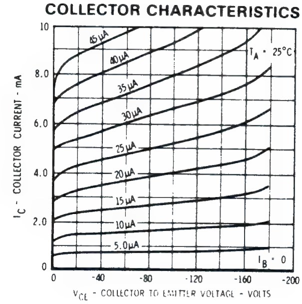
Curve Set number T276

Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

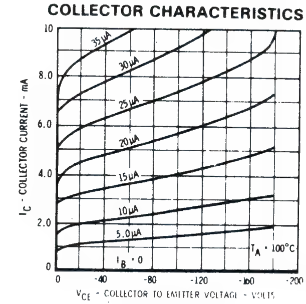
COLLECTOR CHARACTERISTICS



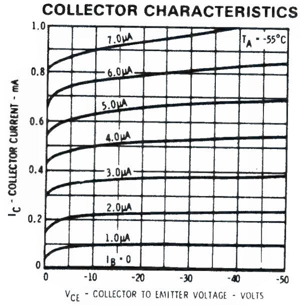
COLLECTOR CHARACTERISTICS



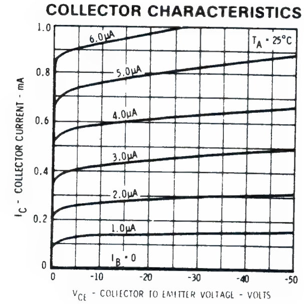
COLLECTOR CHARACTERISTICS



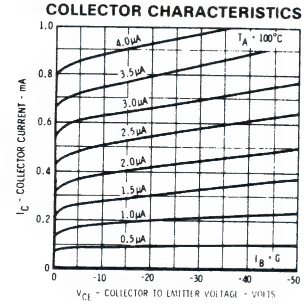
COLLECTOR CHARACTERISTICS



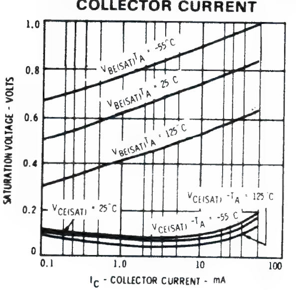
COLLECTOR CHARACTERISTICS



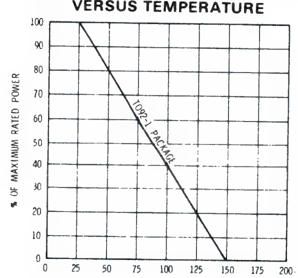
COLLECTOR CHARACTERISTICS



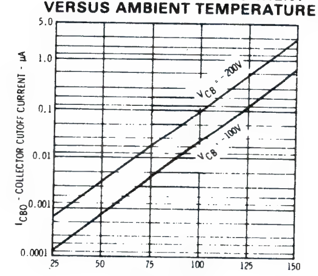
COLLECTOR AND BASE SATURATION VOLTAGES VERSUS COLLECTOR CURRENT



ALLOWABLE POWER DISSIPATION VERSUS TEMPERATURE



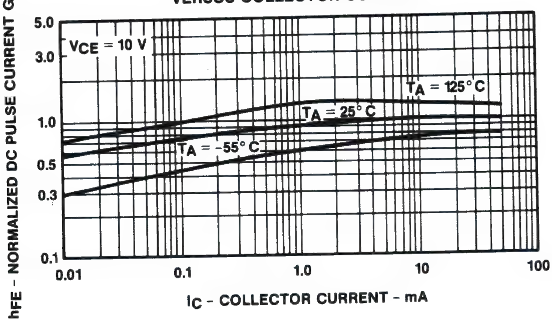
COLLECTOR CUTOFF CURRENT VERSUS AMBIENT TEMPERATURE



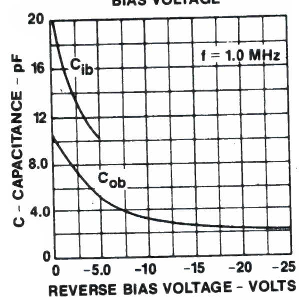
Curve Set number T276

Typical Electrical Characteristic Curves
25° C Ambient Temperature unless otherwise noted

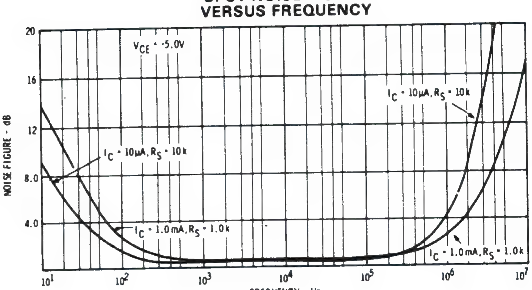
NORMALIZED CURRENT GAIN VERSUS COLLECTOR CURRENT



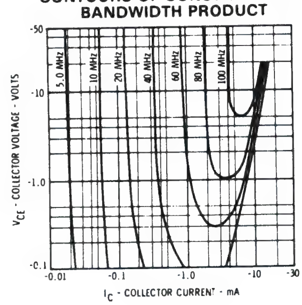
INPUT AND OUTPUT CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



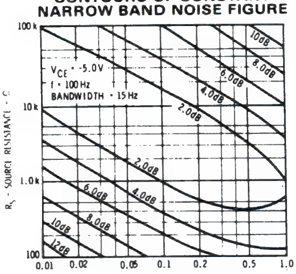
SPOT NOISE FIGURE VERSUS FREQUENCY



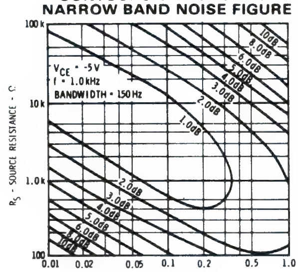
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT



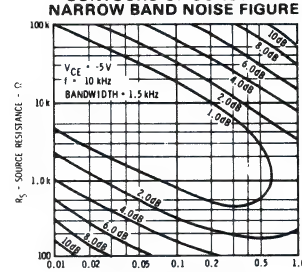
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



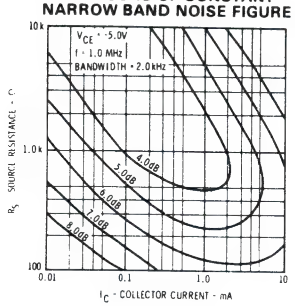
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



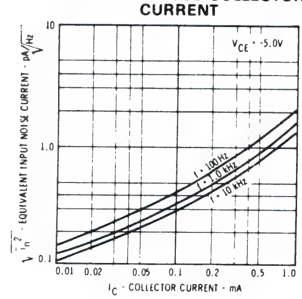
Curve Set number T276

Typical Electrical Characteristic Curves
25° C Ambient Temperature unless otherwise noted

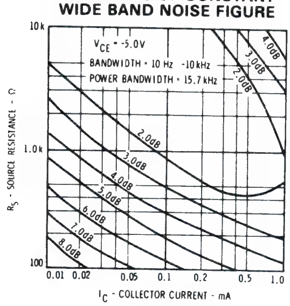
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



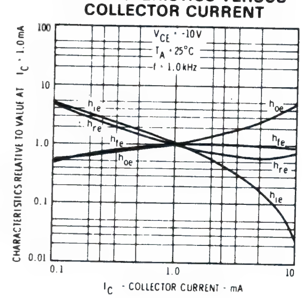
EQUIVALENT INPUT NOISE CURRENT VERSUS COLLECTOR CURRENT



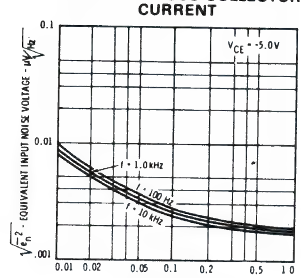
CONTOURS OF CONSTANT WIDE BAND NOISE FIGURE



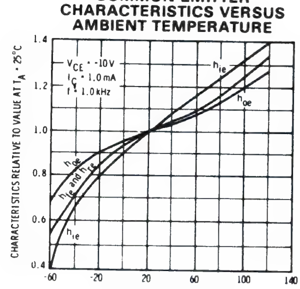
COMMON EMITTER CHARACTERISTICS VERSUS COLLECTOR CURRENT



EQUIVALENT INPUT NOISE VOLTAGE VERSUS COLLECTOR CURRENT



COMMON EMITTER CHARACTERISTICS VERSUS AMBIENT TEMPERATURE



4

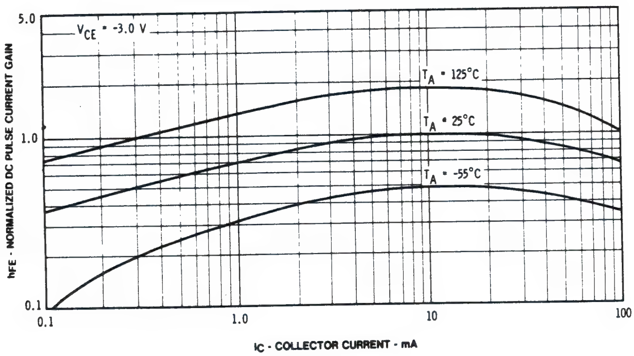
FAIRCHILD

A Schlumberger Company

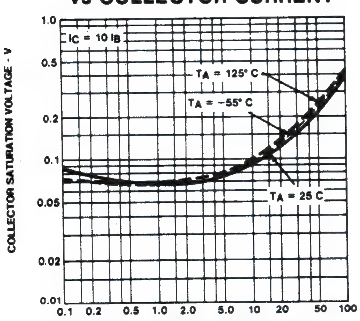
Curve Set number T292

Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

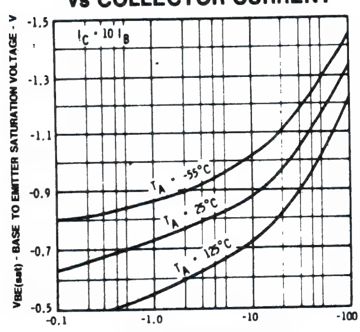
NORMALIZED DC PULSE CURRENT GAIN vs COLLECTOR CURRENT



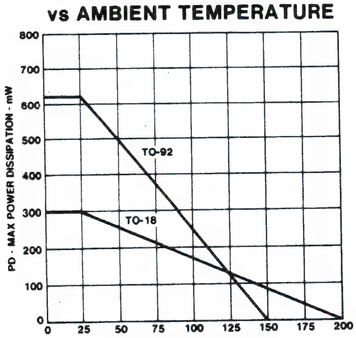
COLLECTOR SATURATION vs COLLECTOR CURRENT



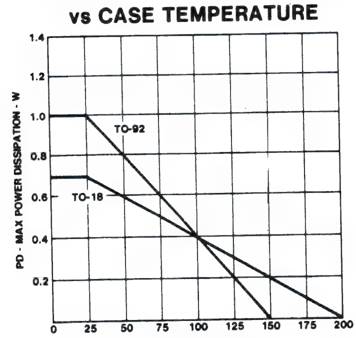
BASE SATURATION VOLTAGE vs COLLECTOR CURRENT



MAXIMUM POWER DISSIPATION vs AMBIENT TEMPERATURE



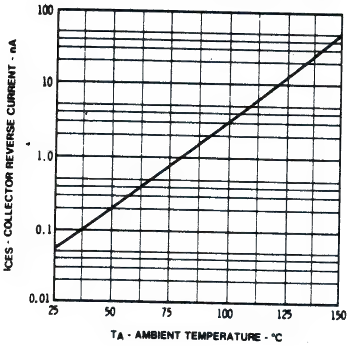
MAXIMUM POWER DISSIPATION vs CASE TEMPERATURE



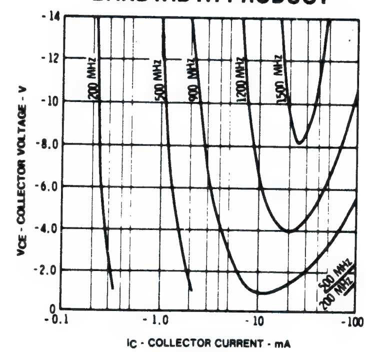
Curve Set number T292

Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

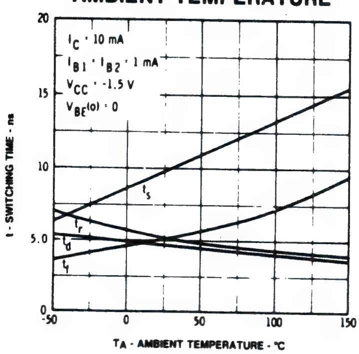
COLLECTOR REVERSE CURRENT vs AMBIENT TEMPERATURE



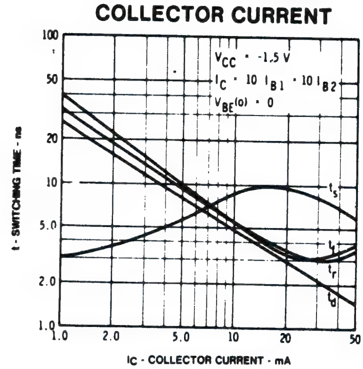
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT



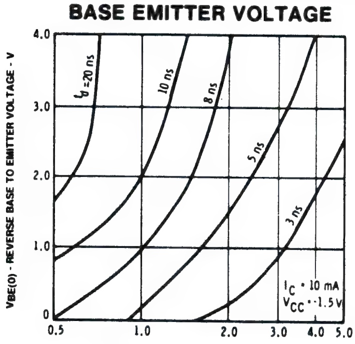
SWITCHING TIMES vs AMBIENT TEMPERATURE



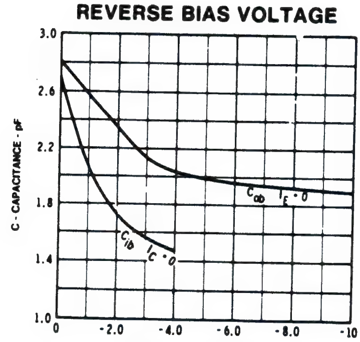
SWITCHING TIMES vs COLLECTOR CURRENT



DELAY TIME vs TURN ON BASE CURRENT AND REVERSE BASE EMITTER VOLTAGE



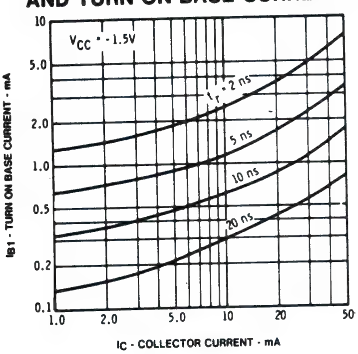
INPUT AND OUTPUT CAPACITANCES vs REVERSE BIAS VOLTAGE



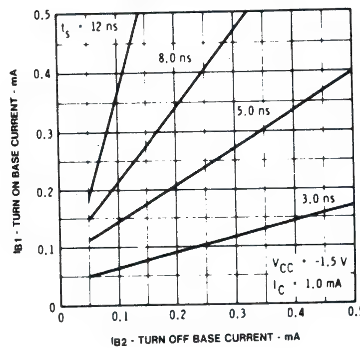
4

Typical Electrical Characteristic Curves 25° C Ambient Temperature unless otherwise noted

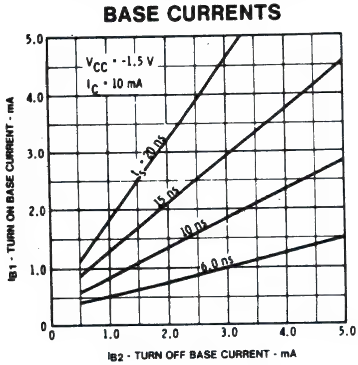
RISE TIME vs COLLECTOR AND TURN ON BASE CURRENTS



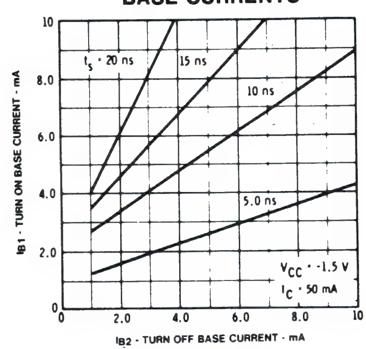
STORAGE TIME vs TURN ON AND TURN OFF BASE CURRENTS



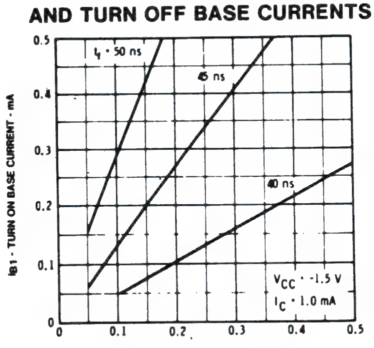
STORAGE TIME vs TURN ON AND TURN OFF BASE CURRENTS



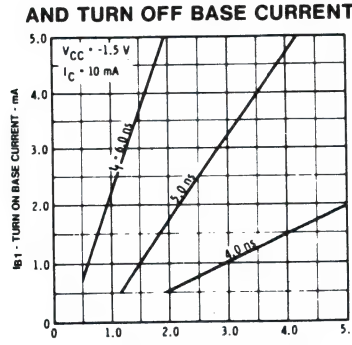
STORAGE TIME vs TURN ON AND TURN OFF BASE CURRENTS



FALL TIME vs TURN ON AND TURN OFF BASE CURRENTS



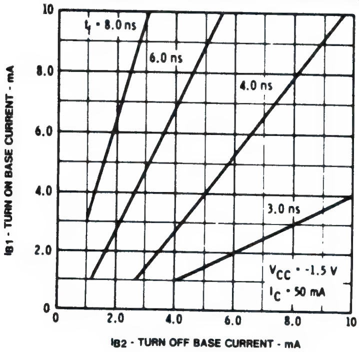
FALL TIME vs TURN ON AND TURN OFF BASE CURRENTS



Typical Electrical Characteristic Curves

25° C Ambient Temperature unless otherwise noted

FALL TIME vs TURN ON AND TURN OFF BASE CURRENTS



4

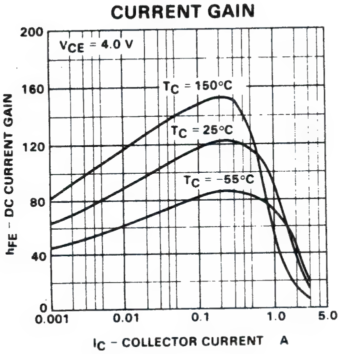
FAIRCHILD

A Schlumberger Company

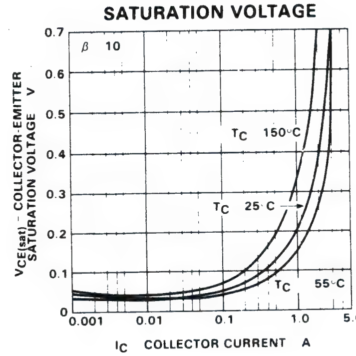
T314 Curve Set

Typical Electrical Characteristic Curves
25° C Ambient Temperature unless otherwise noted

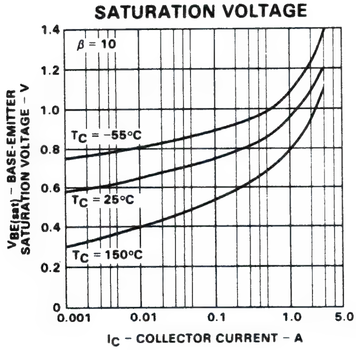
CURRENT GAIN



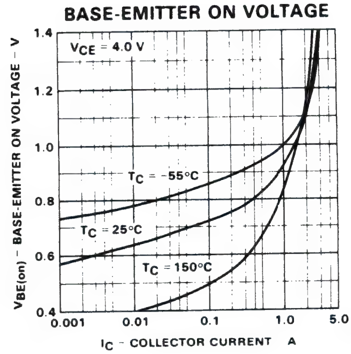
COLLECTOR-EMITTER SATURATION VOLTAGE



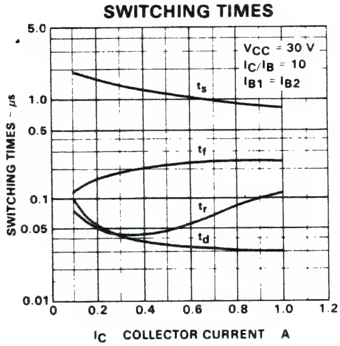
BASE-EMITTER SATURATION VOLTAGE



BASE-EMITTER ON VOLTAGE



SWITCHING TIMES



FAIRCHILD

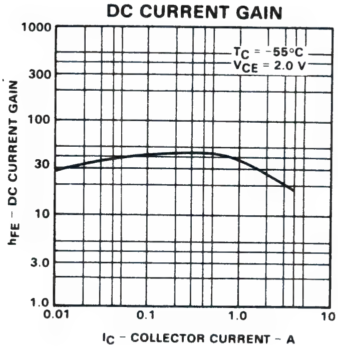
A Schlumberger Company

Curve Set number T315

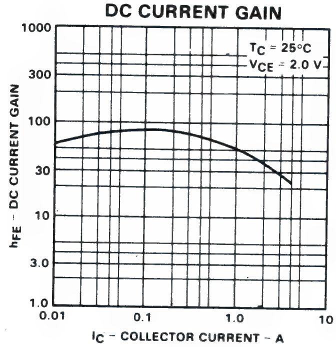
Typical Electrical Characteristic Curves

25° C Ambient Temperature unless otherwise noted

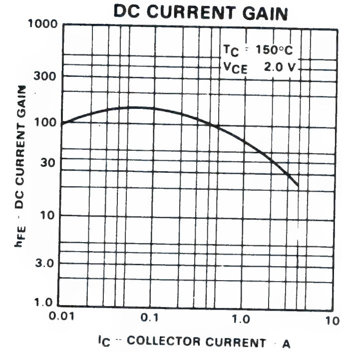
DC CURRENT GAIN



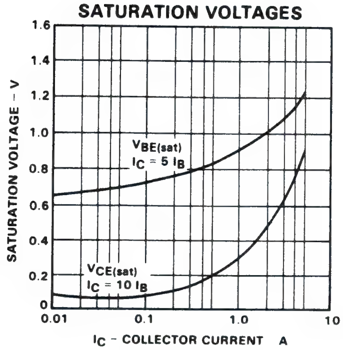
DC CURRENT GAIN



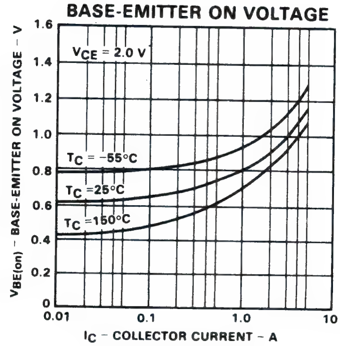
DC CURRENT GAIN



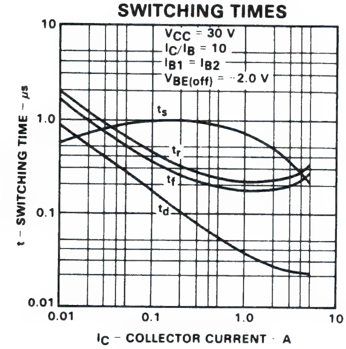
SATURATION VOLTAGES



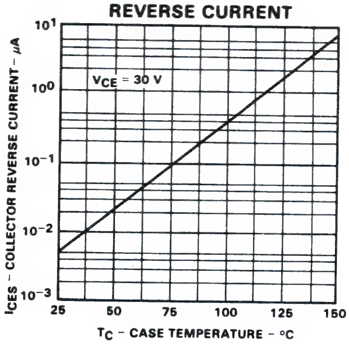
BASE-EMITTER ON VOLTAGE



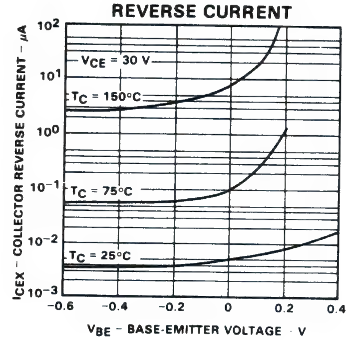
SWITCHING TIMES



COLLECTOR REVERSE CURRENT



COLLECTOR REVERSE CURRENT



Curve Set number T316

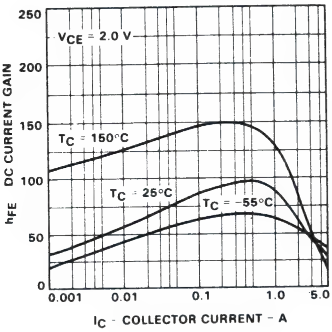
FAIRCHILD

A Schlumberger Company

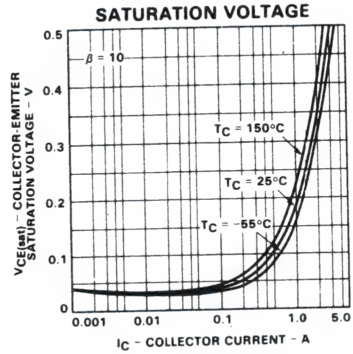
Typical Electrical Characteristic Curves

25° C Ambient Temperature unless otherwise noted

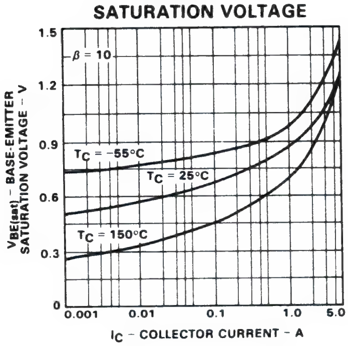
DC CURRENT GAIN



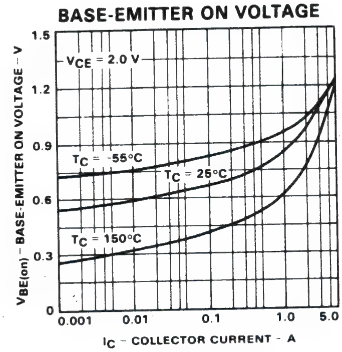
COLLECTOR-EMITTER SATURATION VOLTAGE



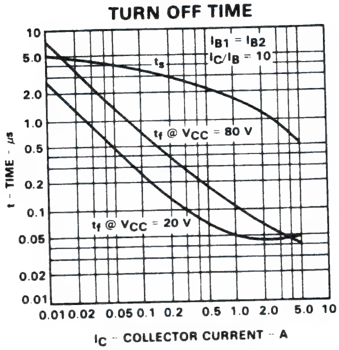
BASE-EMITTER SATURATION VOLTAGE



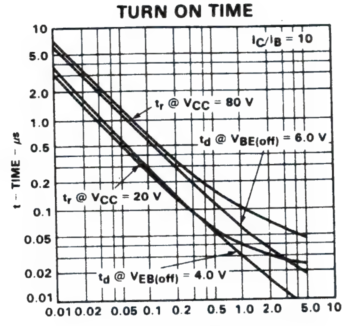
BASE-EMITTER ON VOLTAGE



TURN OFF TIME



TURN ON TIME



FAIRCHILD

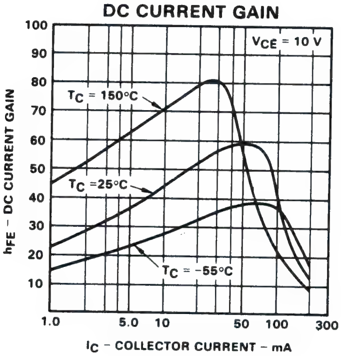
A Schlumberger Company

T333 Curve Set

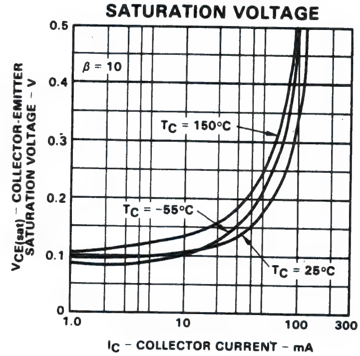
Typical Electrical Characteristic Curves

25° C Ambient Temperature unless otherwise noted

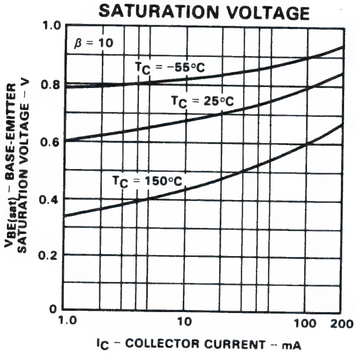
DC CURRENT GAIN



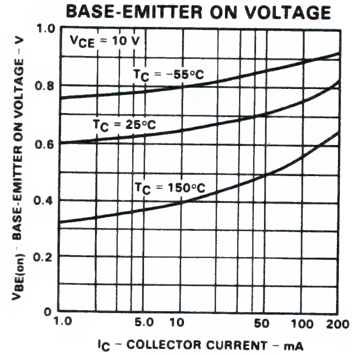
COLLECTOR-EMITTER SATURATION VOLTAGE



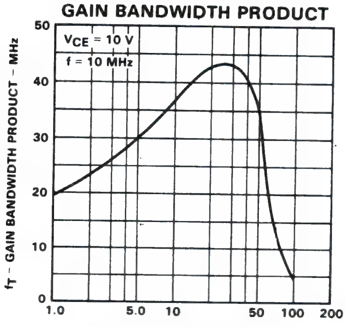
BASE-EMITTER SATURATION VOLTAGE



BASE-EMITTER ON VOLTAGE



GAIN BANDWIDTH PRODUCT



FAIRCHILD

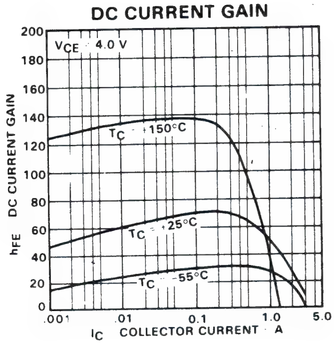
A Schlumberger Company

Curve Set number T414

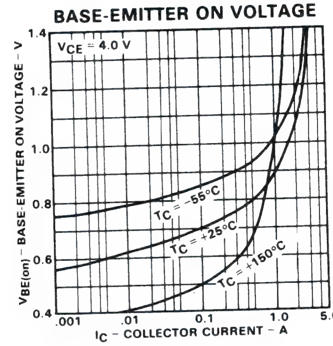
Typical Electrical Characteristic Curves

25° C Ambient Temperature unless otherwise noted

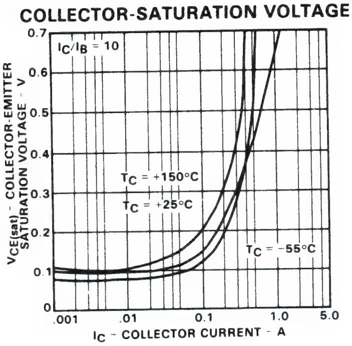
DC CURRENT GAIN



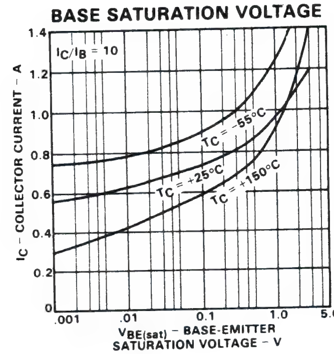
BASE-EMITTER ON VOLTAGE



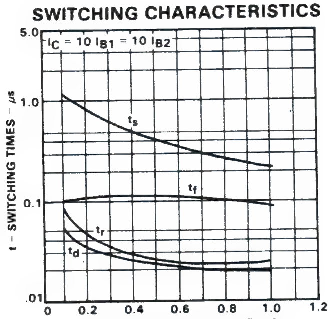
COLLECTOR-SATURATION VOLTAGE



BASE SATURATION VOLTAGE



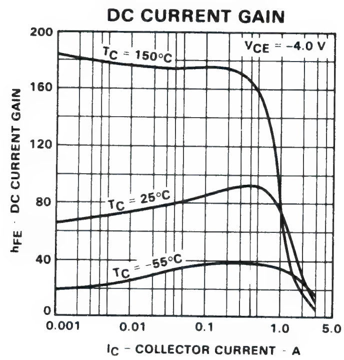
SWITCHING CHARACTERISTICS

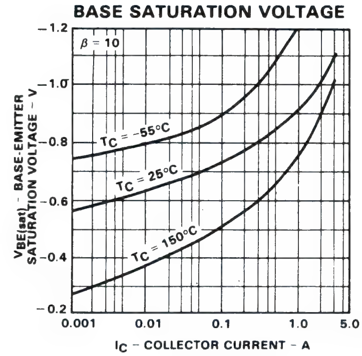


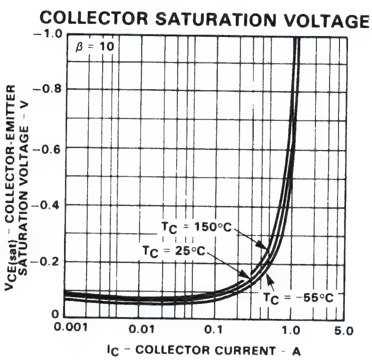
FAIRCHILD
A Schlumberger Company

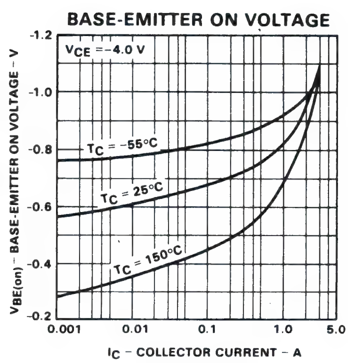
Curve Set number T415

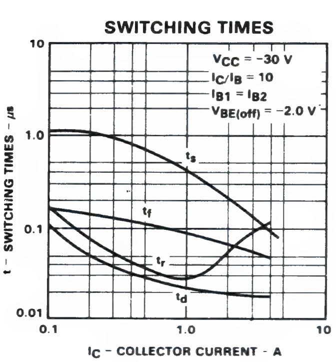
Typical Electrical Characteristic Curves
25° C Ambient Temperature unless otherwise noted







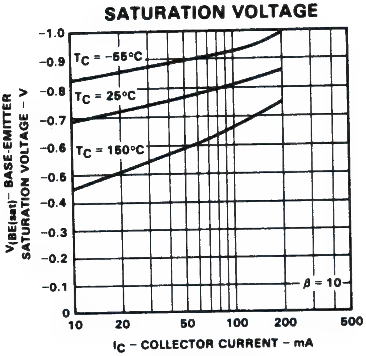




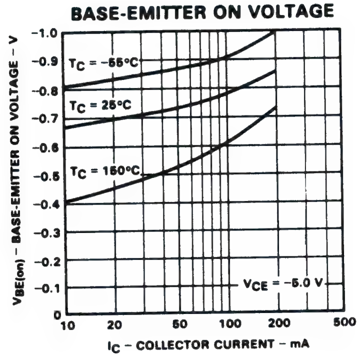
Curve Set number T443

Typical Electrical Characteristic Curves
25° C Ambient Temperature unless otherwise noted

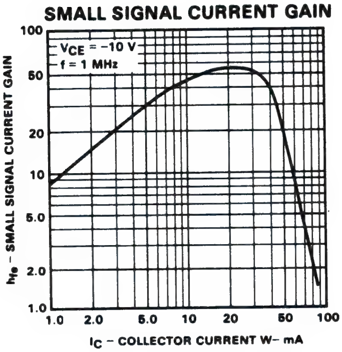
BASE-EMITTER SATURATION VOLTAGE



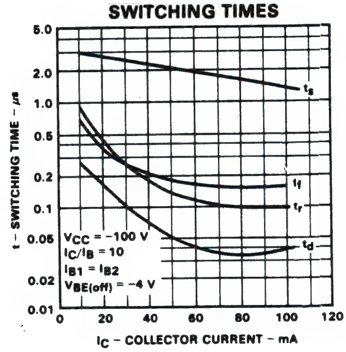
BASE-EMITTER ON VOLTAGE



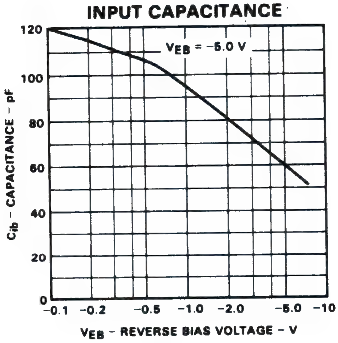
SMALL SIGNAL CURRENT GAIN



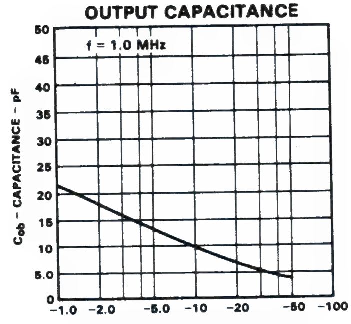
SWITCHING TIMES



INPUT CAPACITANCE



OUTPUT CAPACITANCE

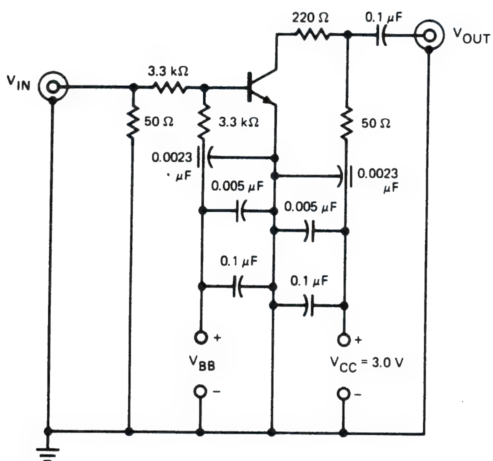


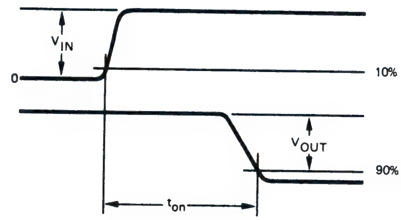
FAIRCHILD

A Schlumberger Company

Test Circuits

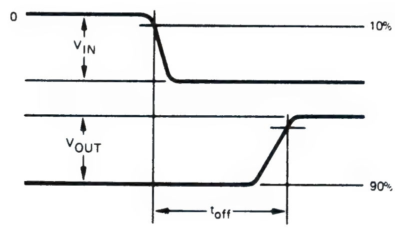
210 t_{on} - t_{off} SWITCHING





V_{BB} = −3.0 V
V_{IN} = +15 V

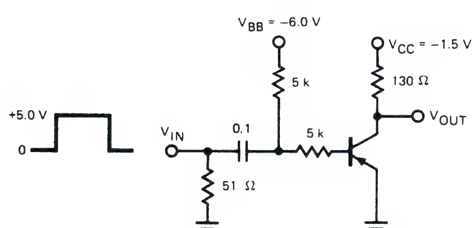
PULSE GENERATOR
V_{IN} t_r < 1.0 ns
SOURCE IMPEDANCE = 50 Ω
PW ⩾ 300 ns
DC < 2%



t_{off}
V_{BB} = +12 V
V_{IN} = −15 V

TO OSCILLOSCOPE
INPUT IMPEDANCE = 50 Ω
t_r ⩽ 1.0 ns

219 t_{on} - t_{off} SWITCHING

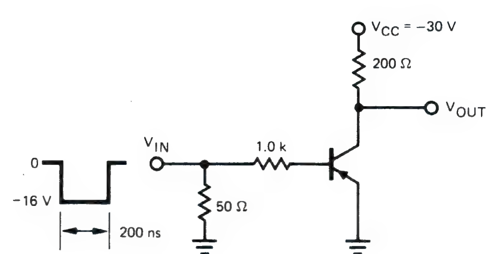


PW = 100 ns
Z_{IN} = 50 Ω
t_r, t_f < 1.0 ns

TO OSCILLOSCOPE
Z_{IN} ⩾ 100 kΩ
t_r < 1.0 ns

I_C ≈ 10 mA, I_{B1} ≈ 0.5 mA, I_{B2} ≈ −0.5 mA

224 t_d - t_r SWITCHING

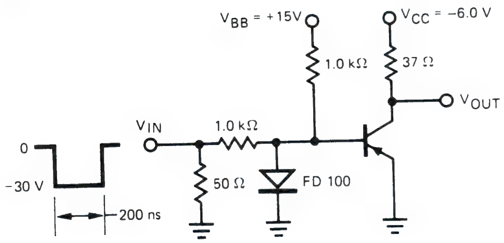


Z_O = 50 Ω
PRF = 150 PPS
t_r ⩽ 2.0 ns

TO OSCILLOSCOPE
t_r ⩽ 5.0 ns
Z_{IN} = 10 MΩ

5

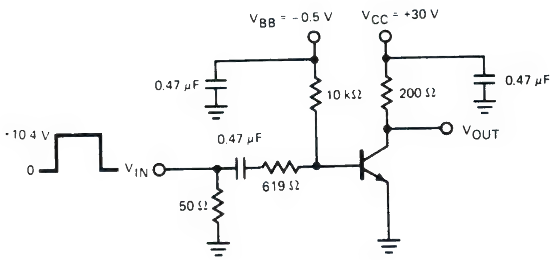
225 $t_s - t_f$ SWITCHING



$Z_O = 50\ \Omega$
PRF = 150 PPS
$t_r \leqslant 2.0$ ns

TO OSCILLOSCOPE
$t_r \leqslant 5.0$ ns
$Z_{IN} = 10\ M\Omega$

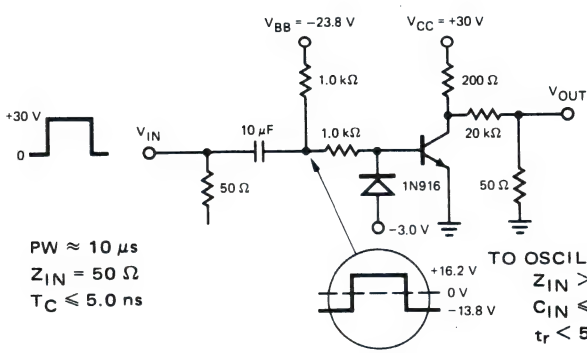
231 t_{on} SWITCHING



PW $\leqslant$ 200 ns
$t_r \leqslant 2.0$ ns
$Z_{IN} = 50\ \Omega$

TO OSCILLOSCOPE
$Z_{IN} < 100\ k\Omega$
$C_{IN} \leqslant 12$ pF
$t_r \leqslant 5.0$ ns

232 t_{off} SWITCHING



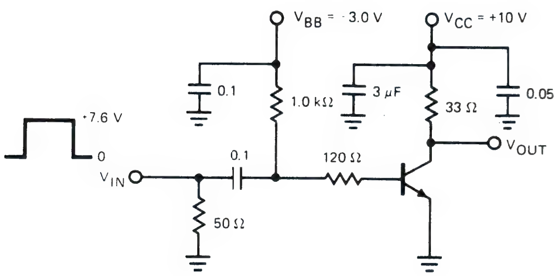
PW ≈ 10 μs
$Z_{IN} = 50\ \Omega$
$T_C \leqslant 5.0$ ns

TO OSCILLOSCOPE
$Z_{IN} > 100\ k\Omega$
$C_{IN} \leqslant 12$ pF
$t_r < 5.0$ ns

The 20 kΩ and 50 Ω resistors on the output of the test circuit are normally omitted, due to the excessive attenuation of the collector waveform. The collector voltage is monitored directly with a high impedance oscilloscope probe.

5

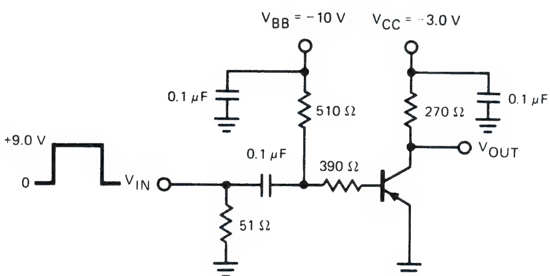
233 t_{on} - t_{off} SWITCHING



PW ⩾ 240 ns
t_r, t_f < 1.0 ns
Z_{IN} = 50 Ω

TO OSCILLOSCOPE
t_r < 1.0 ns
Z_{IN} ≈ 100 kΩ

234 CHARGE STORAGE TIME

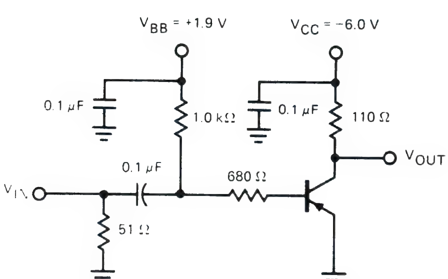


PW = 240 ns
Z_{IN} = 50 Ω
t_r ⩽ 1.0 ns

TO OSCILLOSCOPE
Z_{IN} ⩾ 100 kΩ
t_r < 1.0 ns

I_C ≈ 10 mA, I_{B1} ≈ 10 mA, I_{B2} ≈ 10 mA

235 SWITCHING TIME

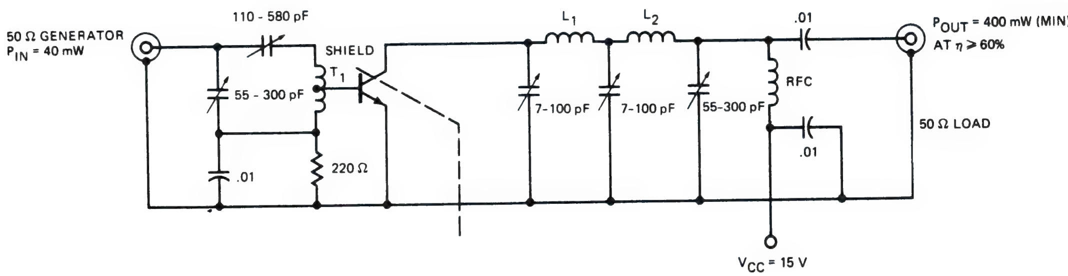


PULSE SOURCE
t_r ⩽ 1.0 ns
PW ⩾ 100 ns
Z_{IN} = 50 Ω
t_r ⩽ 1.0 ns

TO OSCILLOSCOPE
Z_{IN} ⩾ 100 kΩ
t_r ⩽ 1.0 ns

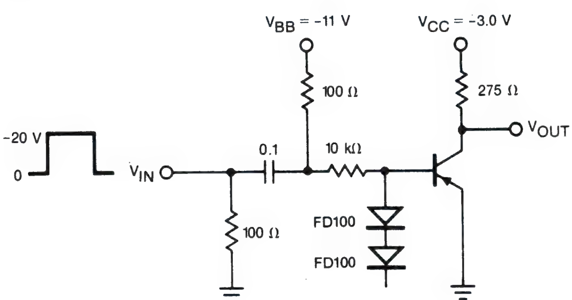
COLLECTOR CURRENT = 50 mA, t_{on} AND t_{off}
BASE CURRENTS = 5.0 mA

238 30 MHz AMPLIFIER



T_1 - 4 TURNS NO. 20 WIRE, 3/4" DIA. X ¼" LONG, MIDTAPPED.
L_1 AND L_2 - 4 TURNS NO. 20 WIRE, ½" DIA. X ¼" LONG.
VARIABLE CAPACITORS ARE COMPRESSION MICA.

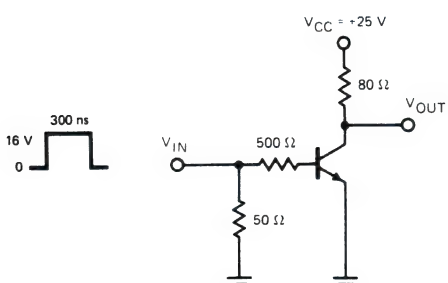
239 t_{off} SWITCHING



PW ≈ 300 ns
$t_r \leq$ 1.0 ns
Z_{IN} = 50 Ω

TO OSCILLOSCOPE
$t_r \leq$ 1.0 ns
Z_{IN} = 100 kΩ

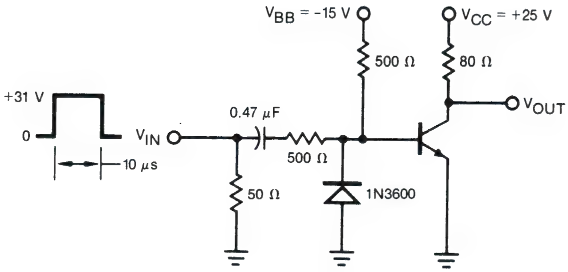
241 t_{on} SWITCHING



PULSE SOURCE
$t_r \leq$ 1.0 ns
Z_{IN} = 50 Ω

TO OSCILLOSCOPE
$t_r \leq$ 1.0 ns
Z_{IN} ≈ 100 kΩ

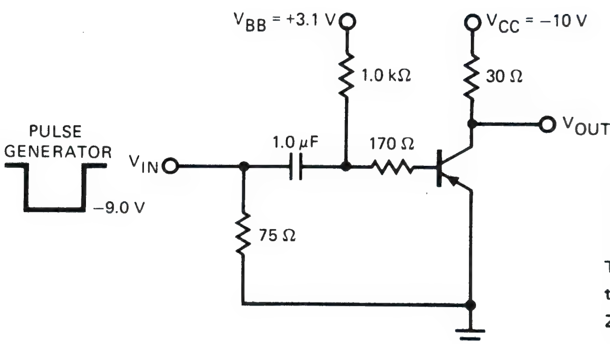
242 t_{off} SWITCHING



PULSE SOURCE
$t_r \leqslant 20$ ns
$Z_{IN} = 50\ \Omega$

TO OSCILLOSCOPE
$t_r \leqslant 1.0$ ns
$Z_{IN} \approx 100\ k\Omega$

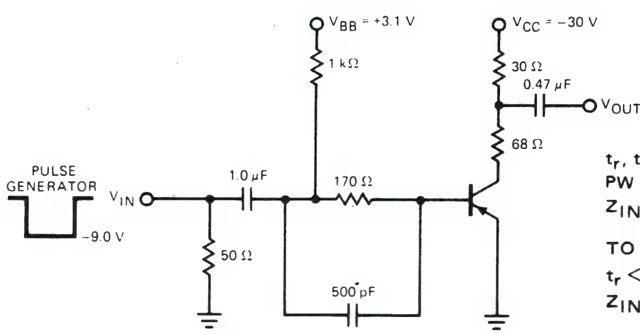
245 t_{on} - t_{off} SWITCHING



t_r, $t_f \leqslant 15$ns
PW = 0.5μs
$Z_{IN} = 50\Omega$

TO OSCILLOSCOPE
$t_r \leqslant 1.0$ ns
$Z_{IN} \geqslant 0.1\ m\Omega$

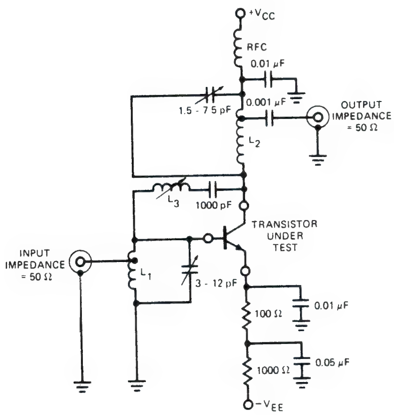
246 t_{on} - t_{off}



t_r, $t_f \leqslant 6$ns
PW = 0.5μs
$Z_{IN} = 50\Omega$

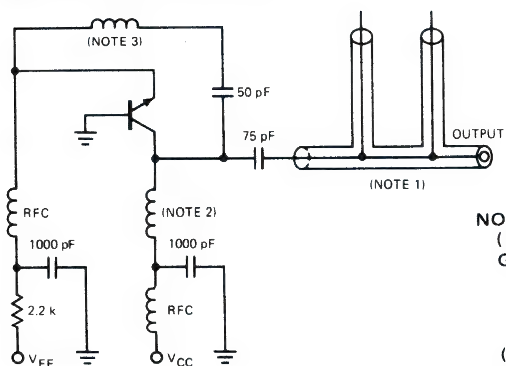
TO OSCILLOSCOPE
$t_r < 1.0$ ns
$Z_{IN} \geqslant 0.1\ M\Omega$

254 GAIN AMPLIFIER



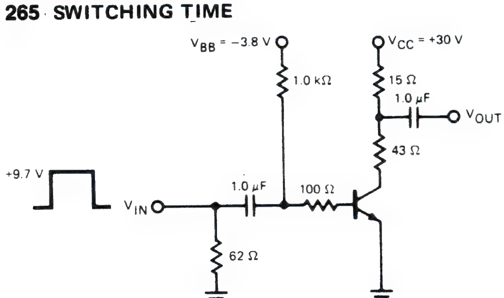
L_1 - 3.5 TURNS #16 WIRE; 5/16" DIA.; 7/16" LONG.
TURNS RATIO 4 TO 2
L_2 - 8 TURNS #16 WIRE; 1/8" DIA.; 7/8" LONG.
TURNS RATIO 8 TO 1
L_3 - 0.4-0.65 μH, ADJUSTABLE CORE

264 500 MHz OSCILLATOR



NOTES:
(1) COAX PLUMBING CONSISTS OF THE FOLLOWING GR AIR LINES:
2 TYPE 874 TEE
1 TYPE 874 - D20 ADJUSTABLE STUB
1 TYPE 874 - LA ADJUSTABLE LINE
1 TYPE 874 - WN3 SHORT - CIRCUIT TERMINATION
(2) 2 TURNS #16 AWG WIRE, 3/8 INCH OD, 1-1/4 INCH LONG
(3) 9 TURNS #22 AWG WIRE, 3/16 INCH OD, 1/2 INCH LONG

265 SWITCHING TIME

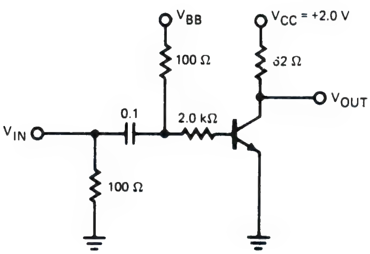


t_r AND $t_f \leqslant 1.0$ ns
PW ≈ 1.0 μs
$Z_{IN} = 50\ \Omega$
DC < 2%

TO OSCILLOSCOPE
$t_r < 1.0$ ns
$Z_{IN} \geqslant 100\ k\Omega$

$I_C \approx 500$ mA, $I_{B_1} \approx 50$ mA, $I_{B_2} \approx 50$ mA

286 t_{on} - t_{off} SWITCHING



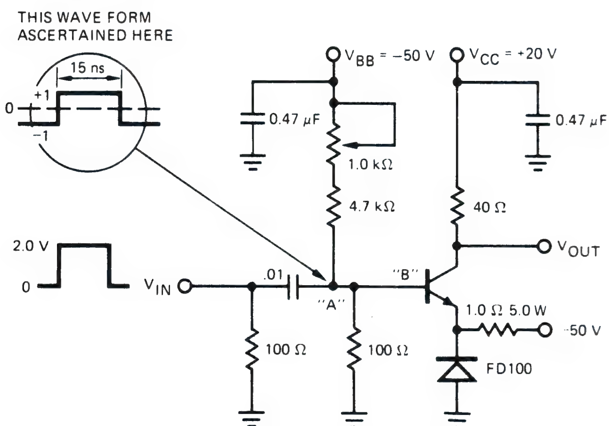
t_{off}: V_{CC} = 2.0 V
V_{BB} = 7.0 V
V_{IN} = −13 V

t_{on}: V_{CC} = 2.0 V
V_{BB} GROUNDED
V_{IN} = 7.0 V

PULSE SOURCE
$t_r < 1.0$ ns
PW > 200 ns
Z_{IN} = 50 Ω

TO OSCILLOSCOPE
$t_r < 1.0$ ns
$Z_{IN} \approx 100$ kΩ

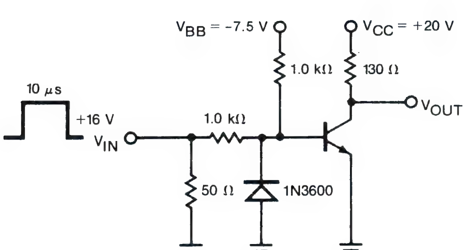
287 t_{on} - t_{off} SWITCHING



PW = 15 ns
$t_f \leqslant 1.0$ ns
Z_{IN} = 50 Ω

TO OSCILLOSCOPE
$t_r = < 1.0$ ns
Z_{IN} = 10 MΩ

288A t_{on} - t_{off} SWITCHING

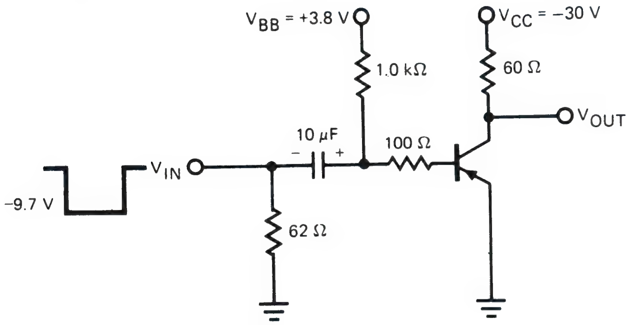


t_r OF INPUT PULSE < 15 ns
t_f OF INPUT PULSE < 15 ns

TO OSCILLOSCOPE
$t_r > 15$ ns
$Z_{IN} \approx 100$ kΩ

5

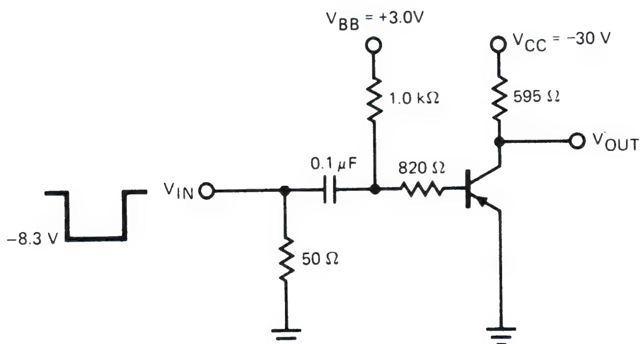
341 t_{on} – t_{off} SWITCHING



PULSE SOURCE
t_r, t_f < 20 ns
Z_{IN} = 50 Ω
PW = 10 μs
DC < 2%

TO OSCILLOSCOPE
Z_{IN} > 100 kΩ
$t_r \approx$ 10 ns

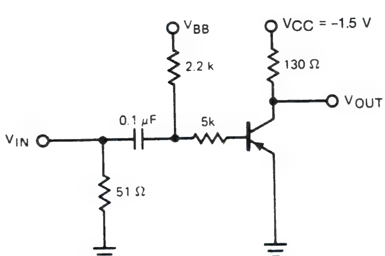
342 SWITCHING TIME



PW = 500 ns
t_r AND t_f = 1.0 ns
Z_{IN} = 50 Ω

TO OSCILLOSCOPE
t_r < 1.0 ns
$Z_{IN} \simeq$ 100 kΩ

348 t_{on} – t_{off} SWITCHING



$I_C \approx$ 10 mA, $I_{B1} \approx$ 1.0 mA, $I_{B2} \approx$ 1.0 mA

t_{on}
V_{BB} = GROUND
V_{IN} = –5.8 V

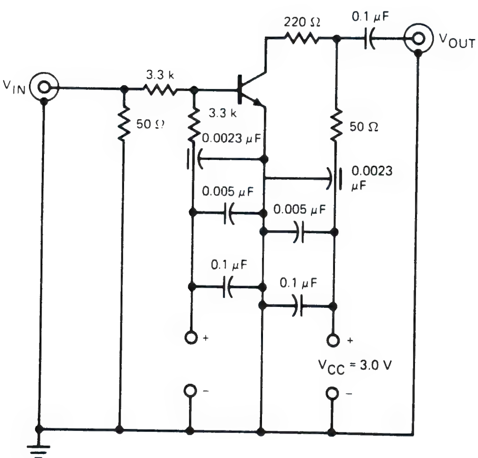
t_{off}
V_{BB} = –8.0 V
V_{IN} = +9.8 V

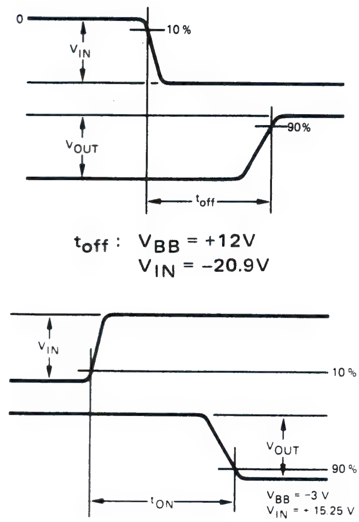
V_{IN}
PW = 240 ns
Z_{IN} = 50 Ω
$t_r \leqslant$ 1.0 ns

TO OSCILLOSCOPE
$Z_{IN} \geqslant$ 100 kΩ
t_r < 1.0 ns

Test Circuits

381 t_{on} - t_{off} SWITCHING



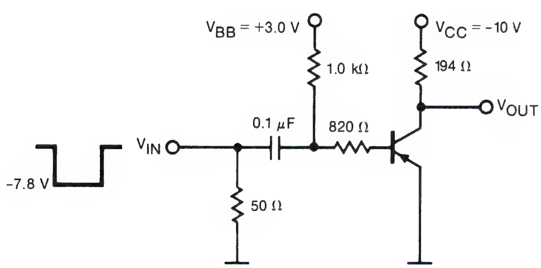


TO OSCILLOSCOPE
Z_{IN} = 50 Ω
$t_r \leqslant 1.0$ ns

PULSE GENERATOR
V_{IN} = $t_r < 1.0$ ns
SOURCE IMPEDANCE
= 50 Ω
PW ⩾ 300 ns
DC < 2%

5

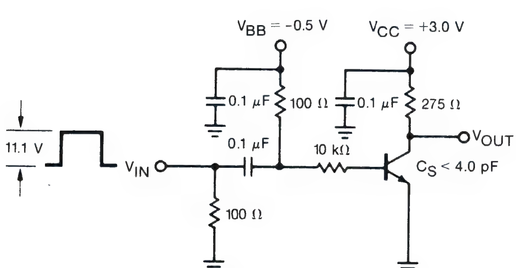
407 SWITCHING TIME



PW = 500 ns
t_r AND t_f = 1.0 ns
Z_{IN} = 50 Ω

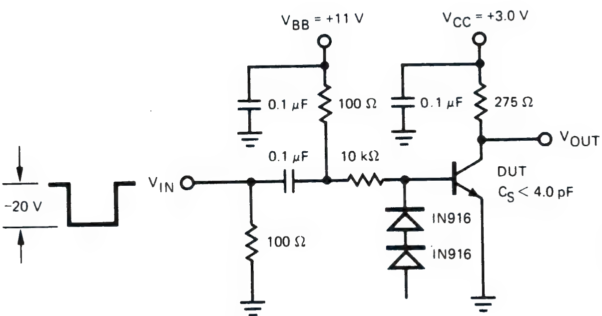
TO OSCILLOSCOPE
$t_r < 1.0$ ns
Z_{IN} = 100 kΩ

526 t_{on} SWITCHING



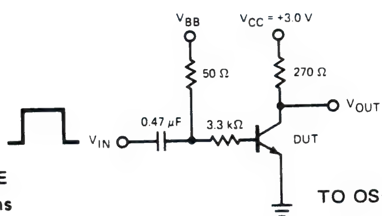
t_r = < 1.0 ns
PW ⩾ 300 ns
DC = 2%

527 t_{off} SWITCHING



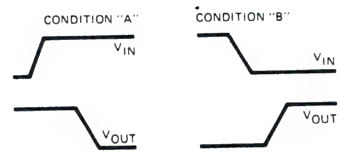
t_r = < 9.0 ns
PW ⩾ 300 ns
DC = 2%

531 t_{on} - t_{off} SWITCHING



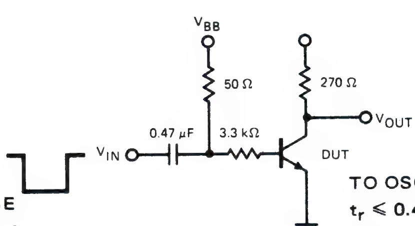
INPUT PULSE
$t_r = t_f \leqslant 2.0$ ns
PW ≈ 300 ns
Z_{IN} = 50 Ω
DC ≈ 2%

TO OSCILLOSCOPE
$t_r \leqslant 0.4$ ns
$R_{IN} \geqslant 100$ kΩ
$C_{IN} \leqslant 4.0$ pF



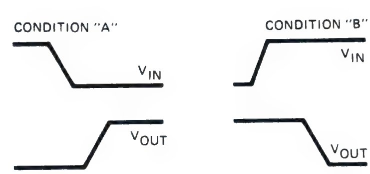
CONDITION "A" = t_d, t_r, t_{on} — 10/3 mA
V_{BB} = −1.5 V V_{IN} = +12.05 V
CONDITION "B" = t_s, t_f, t_{off} — 10/3/1.5 mA
V_{BB} = −4.15 V V_{IN} = +14.85 V
CONDITION "C" = t_s, t_f, t_{off} — 10/3/ 3 mA
V_{BB} = −9.1 V V_{IN} = +19.8 V

532 t_{on} - t_{off} SWITCHING



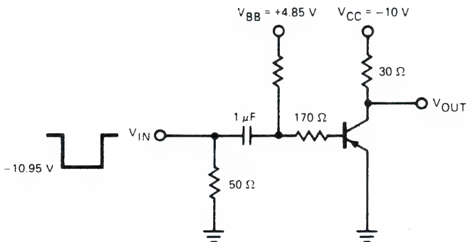
INPUT PULSE
$t_r = t_f \leqslant 2.0$ ns
PW ≈ 300 ns
Z_{IN} = 50 Ω
DC ≈ 2%

TO OSCILLOSCOPE
$t_r \leqslant 0.4$ ns
$R_{IN} \geqslant 100$ kΩ
$C_{IN} \leqslant 4.0$ pF



CONDITION "A" = t_d, t_r, t_{on}
V_{BB} = +1.5 V V_{IN} = −12.05 V
CONDITION "B" = t_s, t_f, t_{off}
V_{BB} = +9.1 V V_{IN} = −19.8 V

536 t_{on} - t_{off} SWITCHING

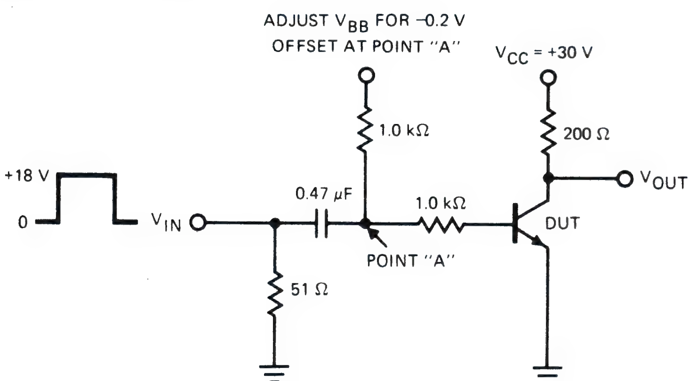


300/30/30 mA

INPUT PULSE
t_r, t_f < 6.0 ns
Z_{IN} = 50 Ω
PW = 0.5 μs
TO OSCILLOSCOPE
t_r < 1.0 ns
$Z_{IN} \geqslant$ 100 kΩ

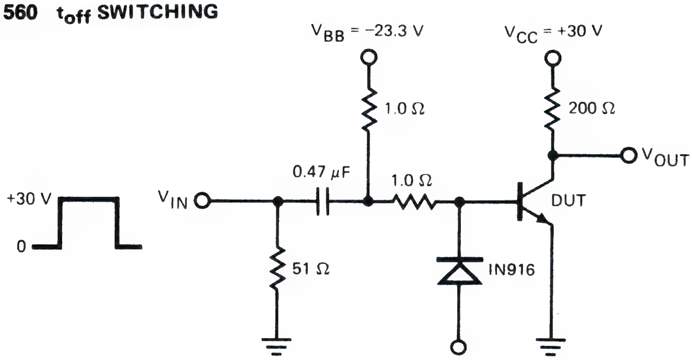
BASE CURRENTS WILL BE EXACT WHEN THE ABOVE VOLTAGES ARE USED. THESE VOLTAGES TAKE THE TERMINATING RESISTOR AND GENERATOR IMPEDANCE INTO ACCOUNT WHEN THE CURRENTS ARE CALCULATED. $VBE_{(sat)}$ IS A NOMINAL 1.0 V.

559 t_{on} SWITCHING



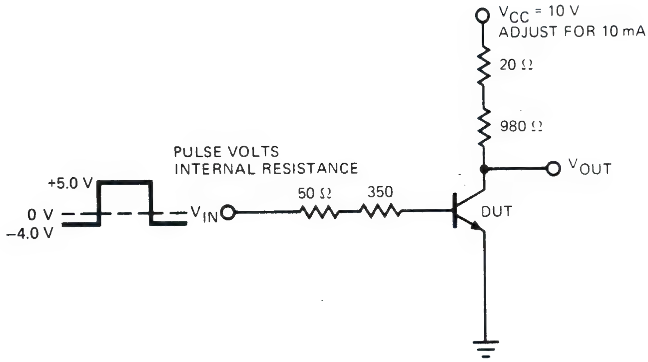
t_r < 2.0 ns
PW = 1.0 μs
DC = 2%

560 t_{off} SWITCHING



$t_r \leqslant$ 2.0 ns
PW = 1.0 μs
DC = 2%

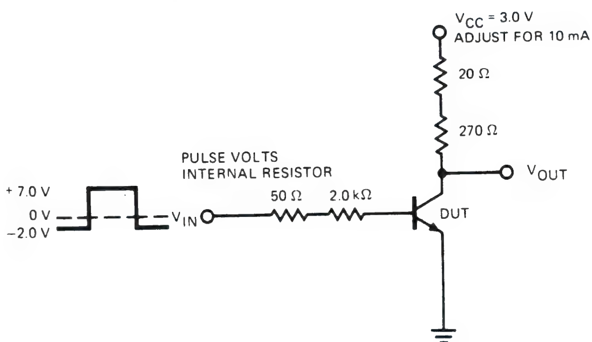
588 τ_s SWITCHING



TYPE R SAMPLING RESISTOR

I_C = 10 mA, I_{B1} = I_{B2} = 10 mA

589 $t_{on} - t_{off}$ SWITCHING

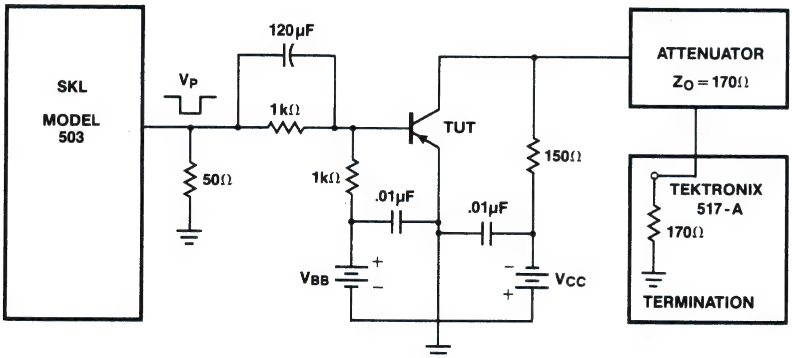


TYPE R SAMPLING RESISTOR

I_C = 10 mA, I_{B1} = 3.0 mA, I_{B2} = 1.5 mA

Test Circuits

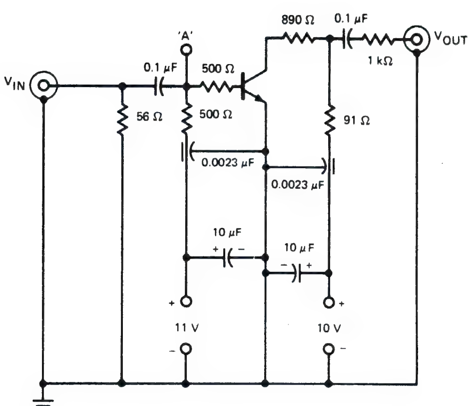
1132A SWITCHING CIRCUIT AND SWITCHING TIMES

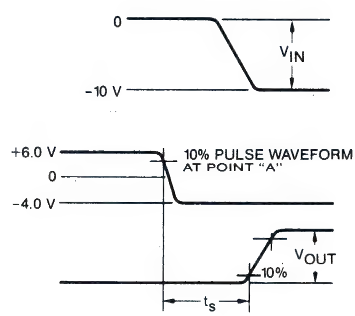


DETERMINATION OF SWITCHING TIMES FROM SCOPE DISPLAY

CONDITIONS: $V_{CC} = -15$ Volts, $V_B = 1.5$ Volts, $V_P = -7.5$ Volts, Pulse Length = 150 nSec

3111 CHARGE STORAGE TIME

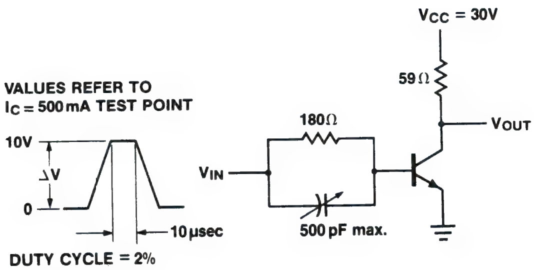




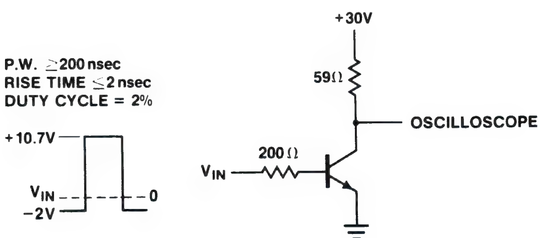
TO OSCILLOSCOPE
$Z_{IN} = 50\ \Omega$
$t_r \leqslant 1.0$ ns

PULSE GENERATOR
$V_{IN}\ t_r < 1.0$ ns
SOURCE IMPEDANCE = 50 Ω
PW $\geqslant$ 300 ns
DC < 2.0%

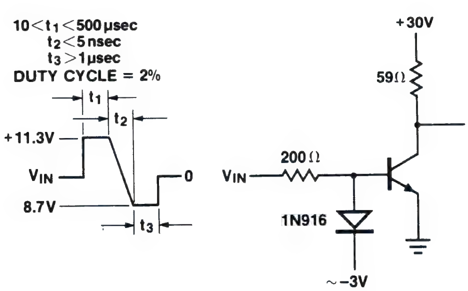
3163 Q_t TEST CIRCUIT



3164 t_d AND t_r SWITCHING CIRCUIT



3165 t_s AND t_f SWITCHING CIRCUIT



Packaging And Ordering Information

I Case Outlines

A. Diode Physical Dimensions (DO-7, DO-35, DO-41)
B. Transistor Physical Dimensions (TO-39, TO-18, TO-92)
C. Surface mount
  1. Leadless diode (LL-34)
  2. SOT 23 (TO-236 AA & AB)
  3. SOIC 8, 14, 16 lead package
D. Diode and Transistor Arrays (4L, TO-85, TO-86, TO-96, TO-116, TO-116-2, TO-33)
E. Photo Transistors (OPTO-26, OPTO-28)

II Packaging Options

A. Diode
  1. Bulk
  2. Tape and reel
    a. axial (fig. 1)
    b. radial (fig. 2)
B. Transistor
  1. Bulk
  2. Tape and reel (fig. 3)
C. Surface Mount
  1. Bulk
  2. Tape and reel (fig. 4)
D. Monolithic arrays
  1. Tubes

III Ordering Information

A. Axial Lead Diodes
  No suffix indicates bulk packaging
    package quantity = 4,000
  TR suffix indicates axial tape and reel
    (50 mm tape spacing) package
  PS suffix indicates axial tape and reel
  (26 mm tape spacing)
    quantity signal diodes –
      DO-35 = 10,000
      DO-41 = 7,000
    package quantity zener diodes
      DO-35 = 5,000
      DO-41 = 3,000
  RT suffix indicates radial tape and reel
    package quantity
      DO-7 = 2,000
      DO-35 = 2,500
      DO-41 = 2,000

B. Transistors
  No suffix indicates bulk packaging
    package quantity
      TO-5 = 400
      TO-18 = 500
      TO-92 = 1,000
  RT suffix indicates radial tape and reel style A
    styles B, C, or D must be special ordered
      package quantity = 2,000
  05 suffix indicates TO-5 lead form
  18 suffix indicates TO-18 lead form

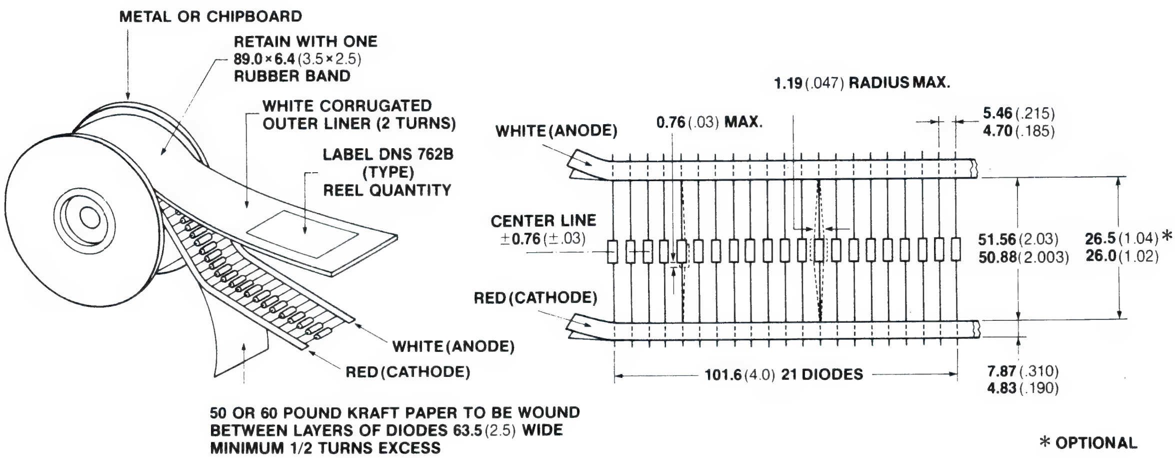
C. Surface Mount Diodes and Transistors (SOT-23)
  1st suffix letter indicates lead form profile
    S = standard profile (TO-236/AA)
    L = low profile (TO-236/AB)
  2nd suffix letter indicates packaging style
    O = bulk
    A = tape and reel style A
    B = tape and reel style B
  package quantity
    bulk = 1,000
    tape and reel = 3,000

D. Leadless Diodes
  D is the first suffix letter for all leadless diodes
  2nd suffix letter indicates packaging style
    O = bulk
    A = tape and reel style A
    B = tape and reel style B
  package quantity
    bulk = 3,000
    tape and reel = 3,000

E. Examples
  PN2222A, radial T&R style A
    order as: PN2222A.RT
  PN2222A with TO-5 lead form
    order as: PN2222A.05
  1N4148 tape & reel
    order as: 1N4148.TR
  FTSO2222A, low profile, T&R style A
    order as: FTSO2222A.LA
  FDLL4148 T&R style B
    order as: FDLL4148.DB

Packaging And Order Information

Figure 1



Note: All dimensions in millimeters (bold) and inches (parenthesis)

Figure 2

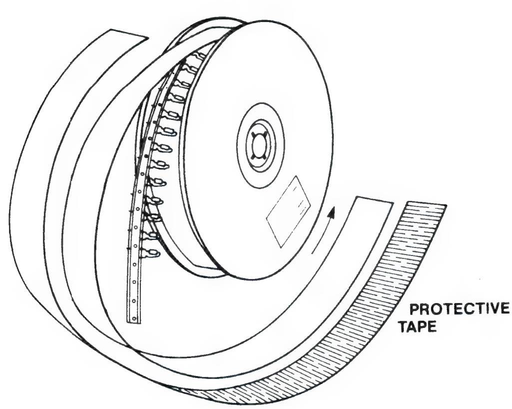


Figure 2 continued

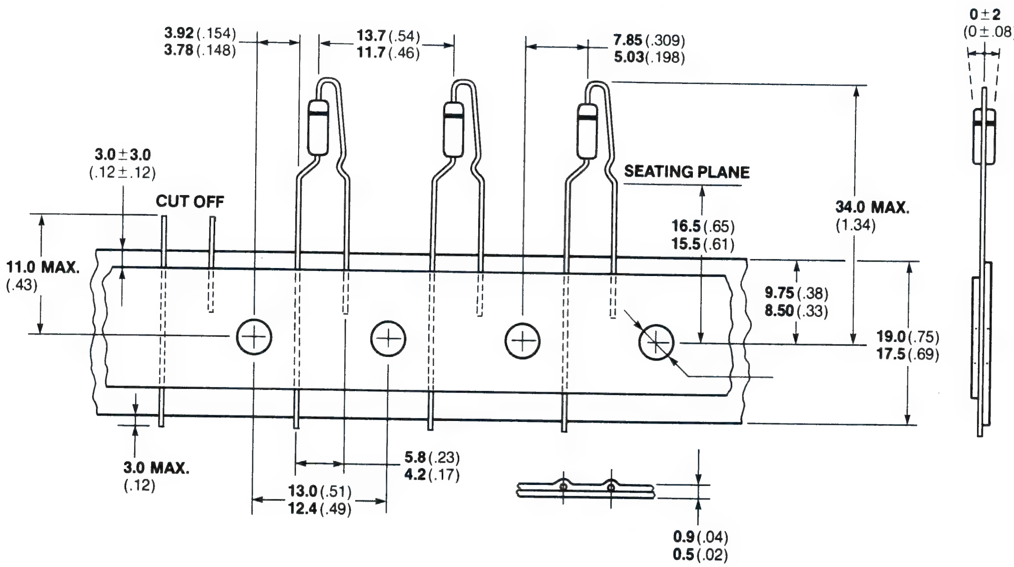
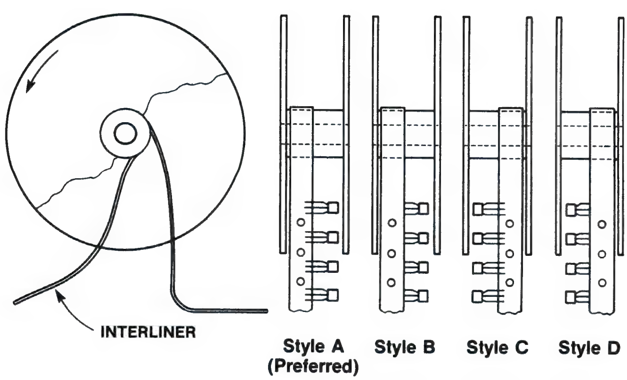


Figure 3



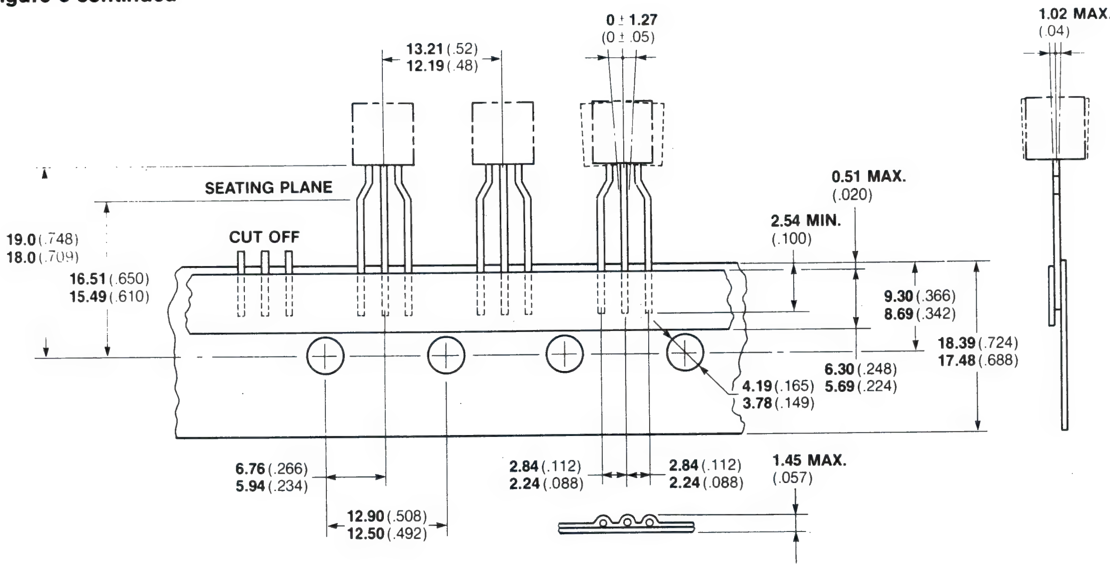
Style A: FSC STD (Preferred) Transistor flat side down, carrier tapes to the left. Emitter leads when unreeling.
Style B: Transistor flat side up, carrier tapes to the left. Collector leads when unreeling.
Style C: Transistor flat side down, carrier tapes to the right. Collector leads when unreeling.
Style D: Transistor flat side up, carrier tapes to the right. Emitter leads when unreeling.

Note: All dimensions in millimeters (bold) and inches (parenthesis)

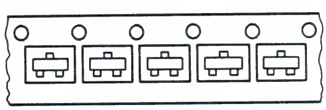
6

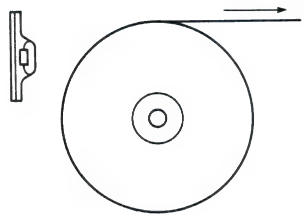
Packaging And Order Information

Figure 3 continued

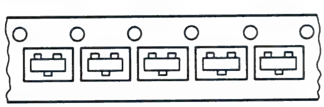


SOT-23 Style A



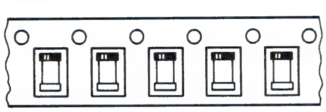


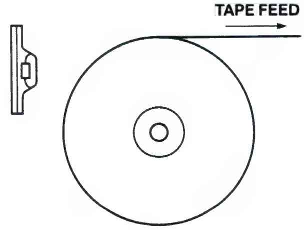
Style B



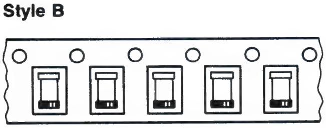
EIA Std RS481

LL-34 Style A





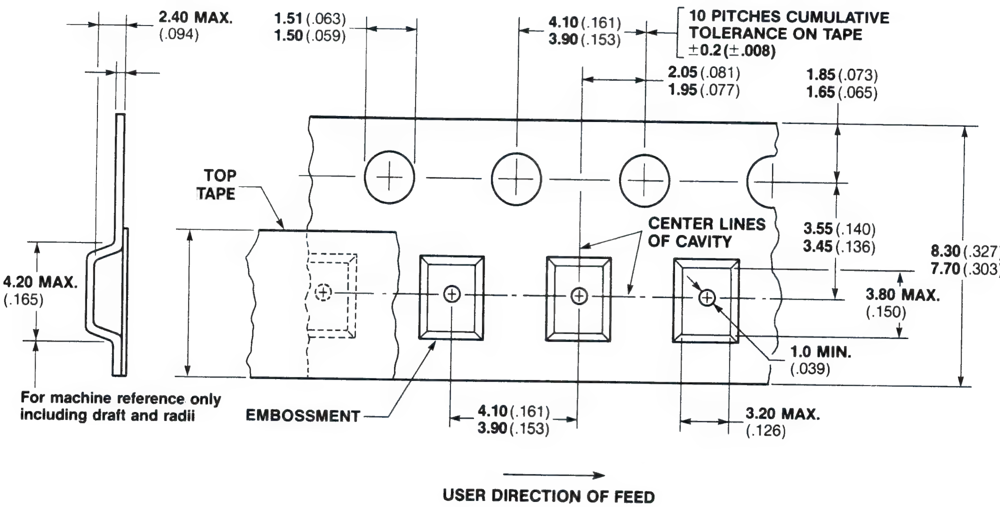
Style B

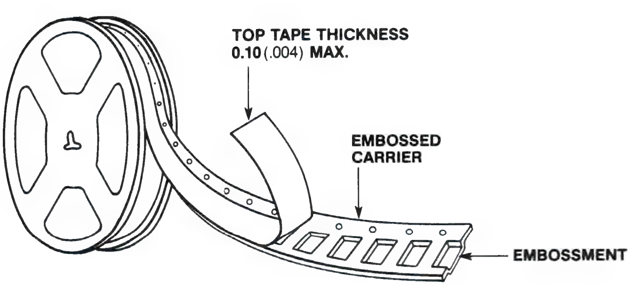


NOTE: Polarity band indicates cathode

Note: All dimensions in millimeters (bold) and inches (parenthesis)

Figure 4

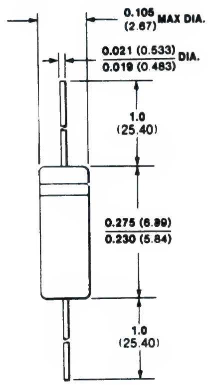




Note: All dimensions in millimeters (bold) and inches (parenthesis)

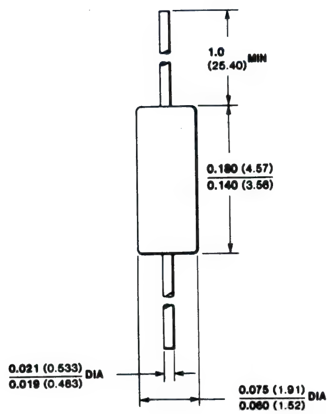
Packaging And Order Information

DO-7



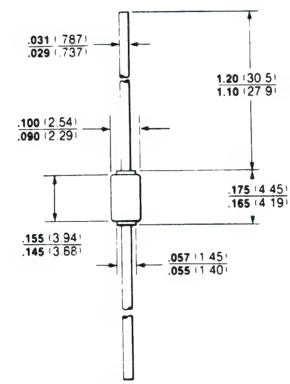
NOTES:
Dumet leads, tin plated
Gold plated leads available
Hermetically sealed glass package
Package weight is 0.19 gram

DO-35



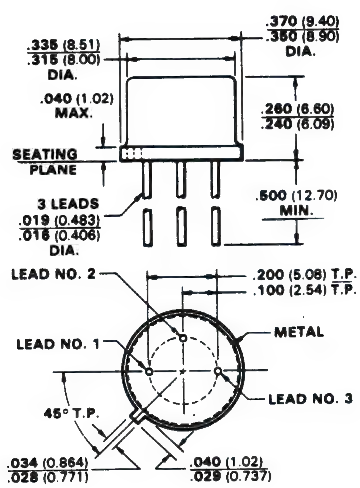
NOTES:
Copper clad steel leads, tin plated
Gold plated leads available
Hermetically sealed glass package
Package weight is 0.14 gram

DO-41



NOTES:
Copper clad steel leads, tin plated
Gold plated leads available
Hermetically sealed glass package
Package weight is 0.30 gram

TO-39

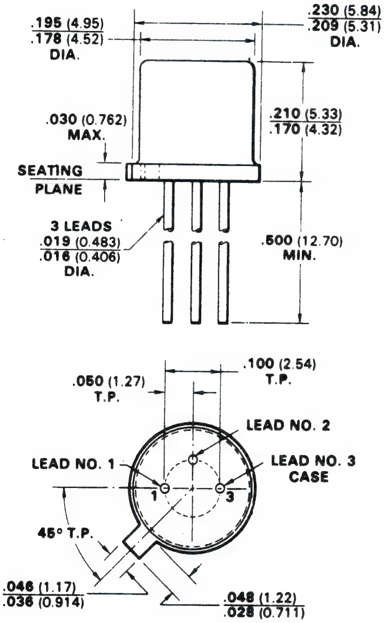


NOTES:
Leads are solder dipped kovar
Lead 3 connected to case
This is a standard package and does not fall into the "special" classification
Package weight is 0.76 gram

Note: All dimensions in inches (bold) and millimeters (parenthesis).

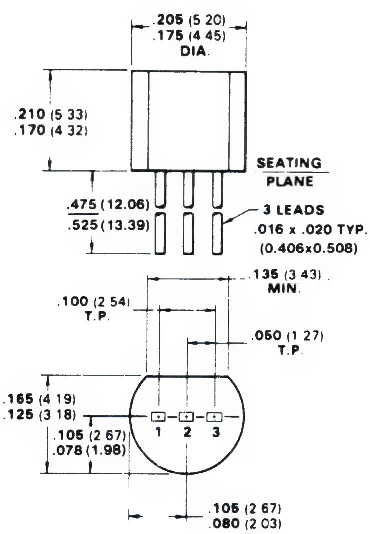
Packaging And Order Information

TO-18



NOTES:
Leads are gold-plated kovar
Lead 3 connected to case
8 mil kovar header
Package weight is 0.44 gram

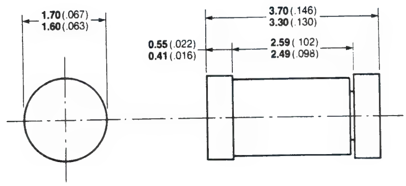
TO-92



NOTES:
Package material is transfer molded thermosetting plastic
Package weight is 0.25 gram
Leads are solder dipped.

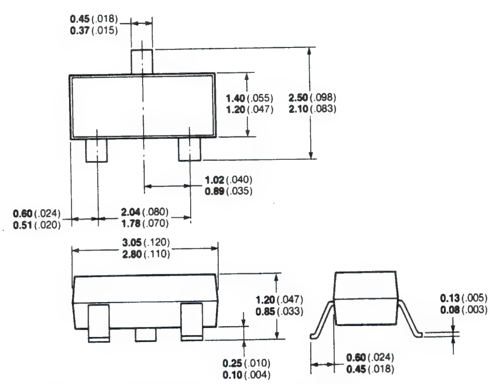
TO-92 PIN CONFIGURATION		
PIN 1	PIN 2	PIN 3
E	B	C

LL-34



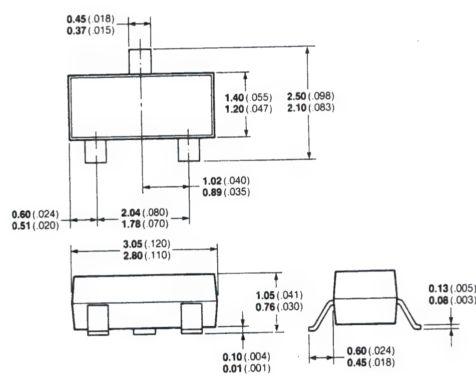
Note: All dimensions in millimeters (bold) and inches (parenthesis)

TO-236AA

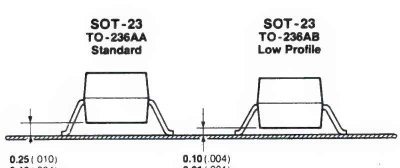


NOTES: 1. Meets all JEDEC dimensional requirements for TO-236AA
2. Controlling dimension: millimeters

TO-236AB



NOTES: 1. Dimensioning and tolerancing per ANSI Y14.5, 1982
2. Controlling dimension: millimeters

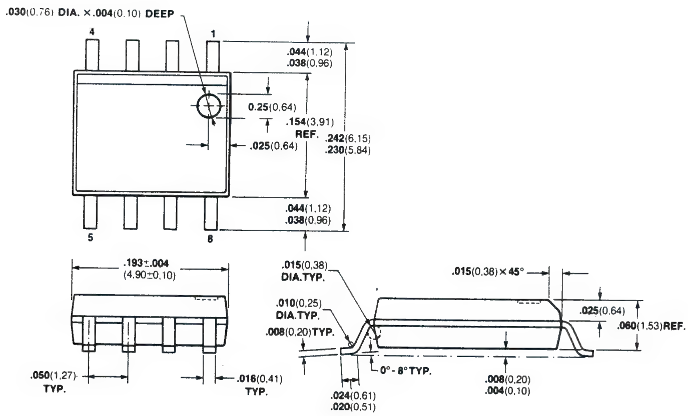


NOTE: Footprint is the same for standard and low profile package

Note: All dimensions in millimeters (bold) and inches (parenthesis)

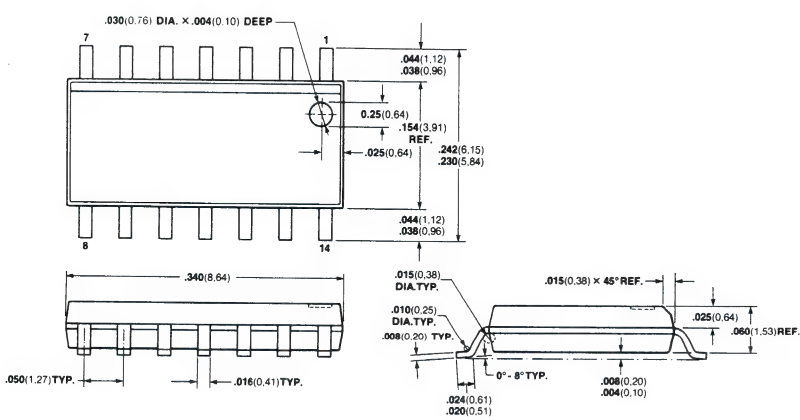
Packaging And Order Information

8-SOIC



6

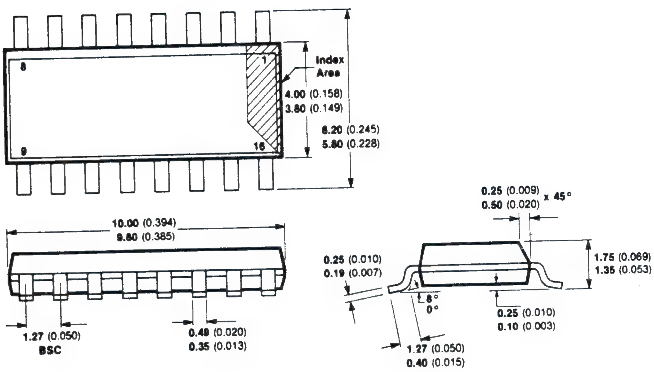
14-SOIC



Note: All dimensions in millimeters (bold) and inches (parenthesis)

Packaging And Order Information

16-SOIC



Notes

Index area: a notch or Lead One identification mark shall be located adjacent to Lead One and shall be located within the shaded area shown.

Leads are copper alloy, either tin plated or solder coated.

Package plastic material is nonvolac epoxy.

Total flash not to exceed **0.15** (0.006) over body dimensions.

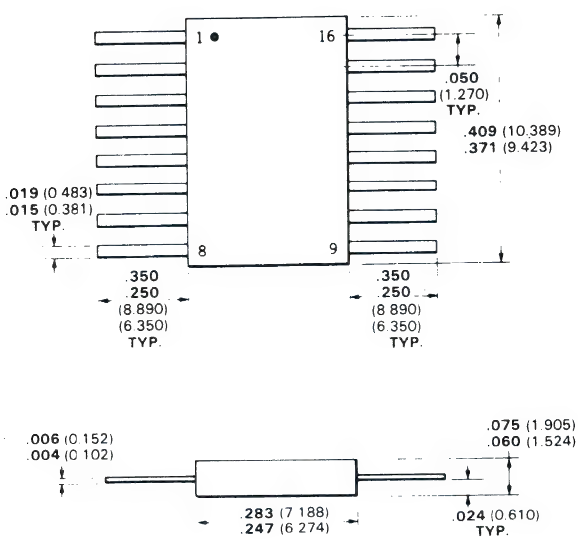
Conforms to variation AC of proposed JEDEC outline for **3.75** (0.150) wide body small outline (SO) family.

All dimensions are typical unless otherwise specified.

Controlling dimensions are metric dimensions.

Note: All dimensions in millimeters (bold) and inches (parenthesis)

4L



NOTES:

Pins are alloy 42

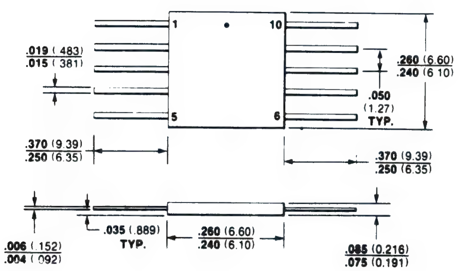
Package weight is 0.4 gram

Hermetically sealed beryllia package

Note: All dimensions in inches (bold) and millimeters (parenthesis).

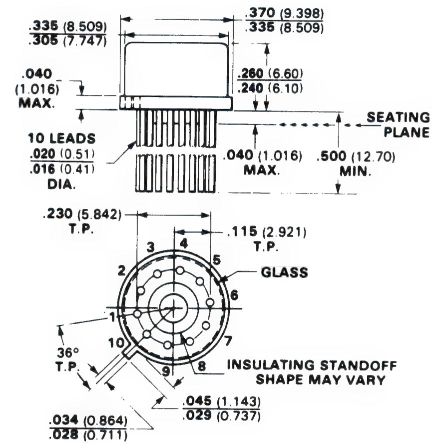
Packaging And Order Information

TO-85



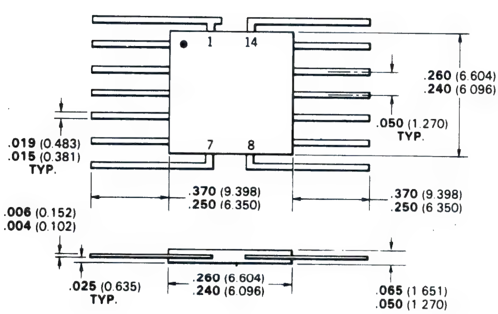
NOTES:
Alloy 42 leads, tin plated
Gold plated leads available
Hermetically sealed ceramic package
Dot or tab indicates lead 1
Package weight is 0.26 gram

TO-96



NOTES:
Kovar leads, gold plated
Hermetically sealed package
Package weight is 1.32 grams

TO-86

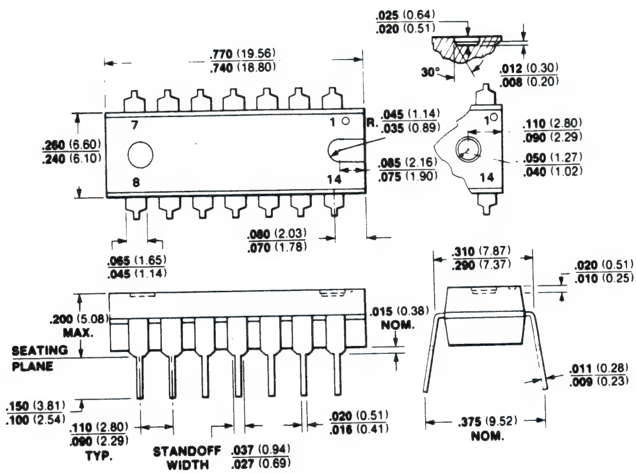


NOTES:
Alloy 42 leads, tin plated
Gold plated leads available
Hermetically sealed ceramic package
Dot or tab indicates lead 1
Package weight is 0.27 gram

Note: All dimensions in inches (bold) and millimeters (parenthesis).

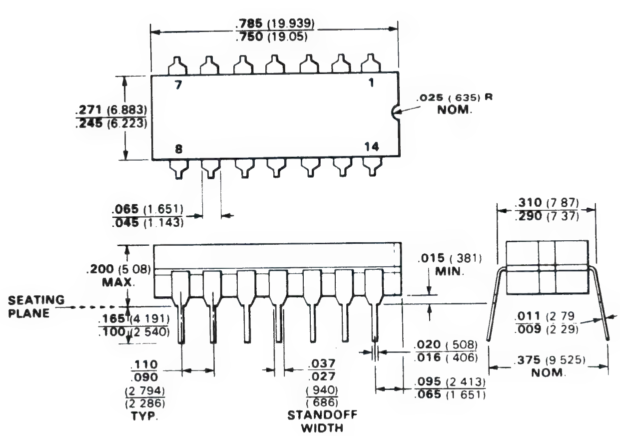
Packaging And Order Information

TO-116



NOTES:
Alloy 42 pins, tin plated
Gold plated pins available
Transfer moulded DM-6B plastic package
Pins are intended for insertion in hole rows on .300" (7.62) centers
They are purposely shipped with "positive" misalignment to facilitate insertion
Board drilling dimensions should equal your practice for .020 (0.508) inch diameter pin
Package weight is 0.9 gram

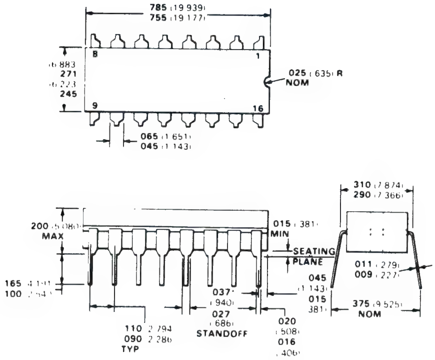
TO-116-2



NOTES:
Alloy 42 pins, tin plated
Gold plated pins available
Hermetically sealed ceramic package
Pins are intended for insertion in hole rows on .300" (7.620) centers
They are purposely shipped with "positive" misalignment to facilitate insertion
Board-drilling dimensions should equal your practice for .020" (0.508) diameter pin
Package weight is 2.0 grams

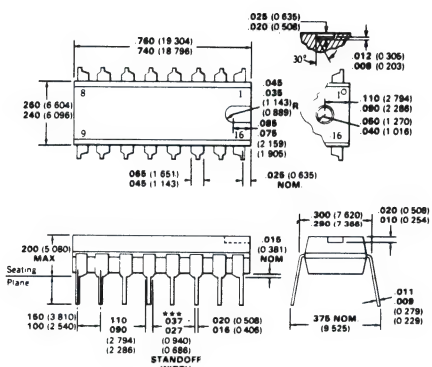
Note: All dimensions in inches (bold) and millimeters (parenthesis).

6B



NOTES:
Alloy 42 pins, tin plated
Gold plated pins available
Hermetically sealed ceramic package
Pins are intended for insertion in hole rows on .300″ centers (7.62)
They are purposely shipped with "positive" misalignment to facilitate insertion
Board-drilling dimensions should equal your practice for .020 inch diameter pin (0.51)
Package weight is 2.0 grams
*The .037−.027 dimension does not apply to the corner pins

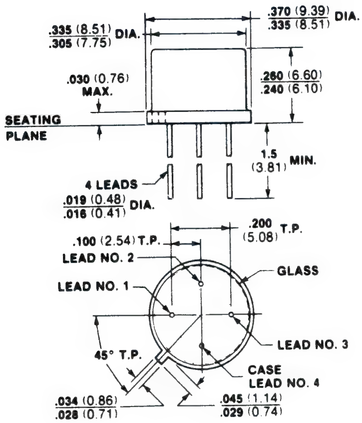
9B



NOTES:
Alloy 42 pins, tin plated
Gold plated pins available
Transfer moulded DM-6B plastic package
Pins are intended for insertion in hole rows on .300″ (7.62) centers
Leads purposely have a "positive" misalignment to facilitate insertion
Board-drilling dimensions should equal your practice for .020 inch (0.51) diameter pin
***The .037−.027 (0.94−0.69) dimension does not apply to the corner pins

Note: All dimensions in inches (bold) and millimeters (parenthesis).

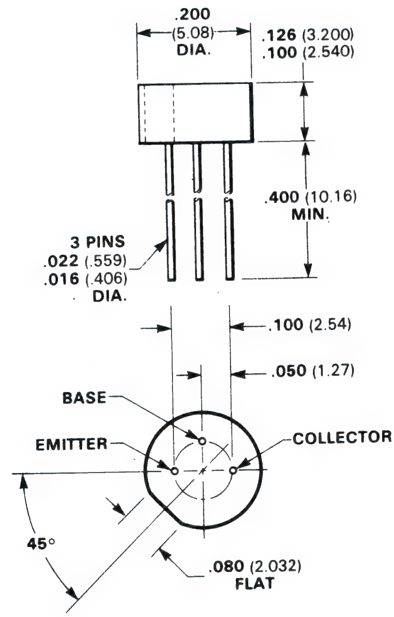
TO-33



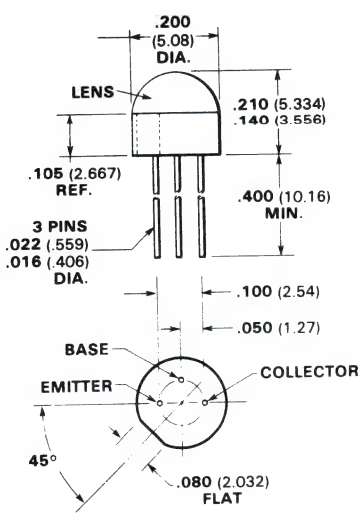
NOTES:
Kovar leads, gold plated
Hermetically sealed package
Package weight is 0.36 gram

Package weight is 1.22 grams

OPTO-28



OPTO-26



Note: All dimensions in inches (bold) and millimeters (parenthesis).

FAIRCHILD

A Schlumberger Company

Discrete Small Signal Hi-Reliability Devices

Fairchild Discrete Small Signal Division offers a complete line of Hi-Reliability devices produced in modern production facilities at San Rafael, California and Cebu, the Phillipines. Although emphasis is placed on designing and built-in quality and reliability, a complete reliability screening program has been established. Most products offered in this data book are available in all of the following Hi-Rel configurations:

- Hi-Rel Wafers and Die
- Military Qualified Diodes & Transistors
- Source Controlled Devices (SCD)
- Custom "Level S" Processing

Hi-Rel Wafers and Die

Refer to the DICE section of this data book for information on WAFER and DIE available in four standard configurations.

Military Qualified Diodes and Transistors

Fairchild maintains qualified status for all the devices listed in Tables 1 & 2. Most devices are available in three standard quality levels, JAN, JANTX, and JAN TXV, as defined by Mil-Std-19500. For short form information, Refer to Section 2, pages 10, 11, 12, 13, 19 and 20.

Source Controlled Devices (SCD)

Many devices listed in this data book are available with processing defined and controlled by customer documents, commonly referred to as SCD's. Using the Fairchild-developed MODULAR PROCESSING table in this section, along with the standard test methods and conditions outlined in this section, complete custom processing can be designed. Fairchild will conform to the requirements of furnished documents, however, reference to modules within the MODULAR PROCESSING sequence (see example) in the SCD as equal to or exceeding the requirements specified will expedite quote response and product delivery.

Custom "Level S" Processing

Top of the line custom built and processed devices, requiring baseline documentation, wafer lot acceptance and traceability, clean room assembly and Level S process controls and screening are available. Consult the factory for details.

Military Qualified Transistors

Qualified Products List

Device No.	Jan	TX	TXV
2N718A	X	X	X
2N930	X	X	
2N1613	X	X	X
2N2218A	X	X	X
2N2219A	X	X	X
2N2221A	X	X	X
2N2222A	X	X	X
2N2369A	X	X	X
2N2484	X	X	X
2N2904A	X	X	X
2N2905A	X	X	X
2N2906A	X	X	X
2N2907A	X	X	X
2N2920	X	X	X
2N3019	X	X	X
2N3700	X	X	X
2N2060	X	X	
1N457	X		
1N458	X		
1N459	X		
1N483B	X	X	X
1N485B	X	X	X
1N486B	X	X	X
1N914	X	X	X
1N3064	X	X	
1N3070	X	X	
1N3595	X	X	X
1N3600	X	X	X
1N4148-1	X	X	X
1N4150-1	X	X	X
1N4306	X	X	X
1N4307	X	X	X
1N4376	X	X	
1N4454-1	X	X	X
1N4938-1	X	X	
1N5768	X	X	X
1N5770	X	X	X
1N5772	X	X	X
1N5774	X	X	X
1N6100	X	X	X
1N6101	X	X	X

Fairchild Standard Test Methods & Conditions

TEST	MIL-STD-750 METHOD	TEST CONDITION	COMMENTS
Internal Visual	2072, 2073, 2074		
High Temp Storage	1032		200° C, 48 hrs.
Temp Cycle	1051	C	-65° C to +200° C, 20 cyc, 15 min. at extremes
Constant Acceleration	2006		30 Kg, Y1, one minute does not apply. (Not applicable to DO-35 pkg.)
Fine Leak	1071	G	5×10^{-8} atmos cc/sec. (Not applicable to DO-35 pkg.)
Gross Leak	1071	C	Test cond. E for glass diodes
HTRB Burn-In	1038 & 1039		150° C, 48 hrs, 80% V_{CB} (transistor), 80% V_R (Diode) min. (use 72 hrs if not followed by Power Burn-In)
Power Burn-In	1038 & 1039	B	Transistors - 160 hrs Diodes - 96 hrs
X-Ray	2076		2 views
External Visual	2071		
Group A	—	—	Mil-Std-19500 Table III, JAN TXV
Group B	—	—	Mil-Std-19500 Table IVb
Group C	—	—	Mil-Std-19500 Table V
Solderability	2026		LTPD = 15, Electrical rejects may be used.
Resistance to Solvents	1022		LTPD = 15, Electrical rejects may be used.

Discrete Small Signal Hi-Reliability Devices

Modular Processing
(Using standard test methods and conditions)

ASSEMBLY LOCATION — SELECT ONE
- 1 USA BUILD
- 2 OFFSHORE BUILD

ASSEMBLY FLOW — SELECT ONE
- 10 INTERNAL VISUAL, HIGH TEMP STORAGE, TEMPERATURE CYCLE, CONSTANT ACCELERATION, FINE LEAK, GROSS LEAK
- 11 INTERNAL VISUAL
- 12 NO INTERNAL VISUAL
- 13 NO INTERNAL VISUAL, HIGH TEMP STORAGE, TEMP CYCLE, CONSTANT ACCELERATION, FINE LEAK, GROSS LEAK

ELECTRICAL SELECTION — SELECT ONE
- 20 STANDARD (refer to DEVICE)
- 21 SPECIAL SELECTION (specify in SCD)

SCREENING — SELECT ONE
- 30 25°C D.C. TEST, HTRB BURN-IN, 25°C D.C. TEST, POWER BURN-IN, 25°C D.C. TEST, DRIFT CRITERIA, CUSTOM MARK, GROUP A SAMPLE
- 31 25°C D.C. TEST, HTRB BURN-IN, 25°C D.C. TEST, 10% P.D.A., CUSTOM MARK, GROUP A SAMPLE
- 32 25°C D.C. R&R, HTRB BURN-IN, 25°C D.C. R&R, POWER BURN-IN, 25°C D.C. R&R, CUSTOM MARK, GROUP A SAMPLE
- 33 CUSTOM MARK, GROUP A SAMPLE

SPECIAL TESTS — SELECT ONE OR MORE
- 40 NONE
- 41 X-RAY PIND
- 42 100% TEMP TESTS
- 43 100% A.C.
- 44 GROUP B
- 45 GROUP C

DATA/SPECIAL INSTRUCTIONS — SELECT ONE OR MORE
- 50 NONE
- 51 ATTRIBUTES DATA
- 52 VARIABLES DATA
- 53 CORRELATION UNITS
- 54 IN-PROCESS SOURCE INSP.
- 55 OUTGOING SOURCE INSP.
- 56 GENERIC GROUP B&C
- 57 RADIATION SAMPLES

Modular Processing Examples

2N2222, 1, 10 21, 32, 41, 44, 45, 51, 52, 55

2N2222
U.S.A. assy.
Internal visual
High temp storage
Temp cycle
Fine leak
Gross leak
Select electrical screen
25° C DC R&R
HTRB burn-in
25° C DC R&R
Power burn-in
25° C DC R&R
Custom Mark
Group A Sample
X-Ray
PIND
Group B
Group C
Attributes data
Variables data
Outgoing source inspection

1N4148, 2, 13, 21, 30, 40, 56

1N4148
Offshore assy.
No internal visual
High temp storage
Temp cycle
Gross leak
Select electrical screen
HTRB burn-in
25° C DC R&R
Power burn-in
25° C DC test
Drift criteria
Custom mark
Group A sample
Generic Gp B & C

2N2222, 2, 12, 21, 33, 40, 56

2N2222
Offshore assy.
No internal visual
Select electrical screen
Custom mark
Group A
Generic Gp B & C

FAIRCHILD
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Wafer And Dice Information

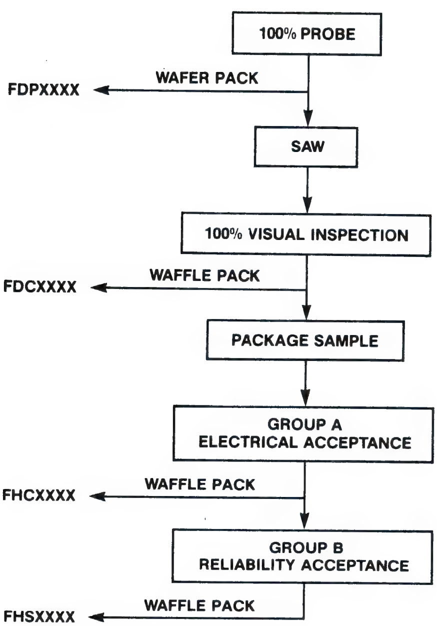
Fairchild's Small Signal Discrete Division is now servicing the hybrid applications of Commercial, Aerospace & Defense marketplaces with diode and transistor chips.

All die types from diode and transistor packaged devices are offered in levels ranging from electrically probed wafers for volume commercial applications to individually processed die for ultra high reliability applications specifying Mil-Std-883, Method 5008 Requirements.

Standard Manufacturing Flows

A standard processing die flow compatible with manufacturing capabilities satisfies commercial and high reliability requirements. Variations of the standard flow may be available to satisfy specific Source Control Drawing requirements.

Standard Wafer and Die Flow



Die Description

Physical properties:

- Topside metallization is aluminum, aproximately 1 micron thick, excellent for all wire bonding techniques.
- Backside metalizaton of gold approximately 8000 Angstroms offers ease of die bonding for eutectic or epoxy with good thermal characteristics.
- Nitride passivation surface protection.
- Die size per die pictorial diagrams.

Product Selection

- **Product electrical** performance may be selected in one of two ways:
  1) Using the Product Selection guide in this section, select the electrical characteristics meeting or exceeding your requirements. The corresponding die type (4 digit number) should then be added to the prefix designating the level of product required.
  2) Knowing the JEDEC device designation, select the corresponding die type using the Device Cross Reference guide in this section. Add the prefix designation for complete product description.

- **Processing Level** may be determined from the Die Flow diagram in this section. Four levels of product are available as standard.

Prefix	Description
FDP,	Probed Wafers
FDC,	Probed, Visualed DICE
FHC,	Probed, Visualed, Group A Sampled DICE
FHS,	Probed, Visualed, Group A & B Sampled DICE

In addition, custom devices are available including special probe parameters, wafer lot acceptance, custom packaging, and radiation sample testing. Consult factory for details.

Wafer And Dice Information

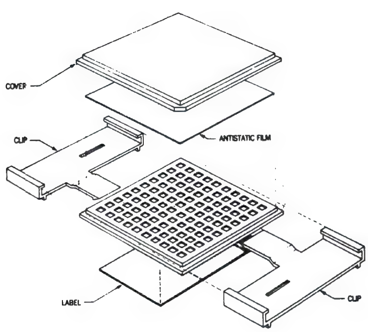
Additional Specifications

1) 100% Probe - 25°C DC parameters only.
2) 100% Visual - Mil-Std-883 Method 2010.
3) Group A - 25°C DC parameters - LTPD = 10%. 25°C AC parameters - LTPD = 15%.
4) Group B - Mil-Std-883 Method 5008.
5) Packaging - Per figure 1.
6) Data - Attributes data supplied with FHC (Group A) and FHS (Group A and B).

Ordering Information

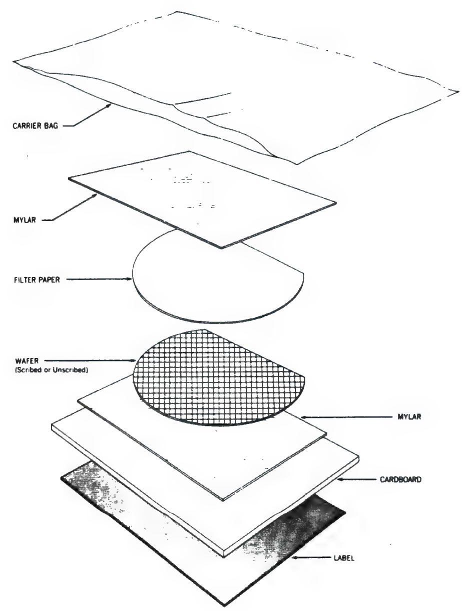
1) Specify prefix from flow chart.
2) Add Die Type from cross reference chart or selection guide.
3) Specify quantity of electrically good die (EGD) required. This applies to both wafers and dice.

Figure 1



CAVITY PACK - Dice are Placed in Individual Compartments. The Plastic Snap Clips Permit Inspection and Resealing.

VIAL PACK - The Vial is Filled with FREON TF and a Plastic Cap Seals the Vial. The Freon Acts as a Motion Retarder and Cleansing Agent.



WAFER PACK - Entire Wafer is Sandwiched Between Two Pieces of Mylar and Vacuum Sealed in a Plastic Envelope.

Wafer And Dice Information

Die Sales Cross Reference
Transistors

2N1893	149B
2N1974	149B
2N1984	149B
2N1986	149B
2N1988	149B
2N1990	149B
2N2192	149A
2N2192A	149A
2N2205	162A
2N2219	145A
2N2219A	145A
2N2221	145B
2N2221A	145B
2N2222	145C
2N2222A	145C
2N2242	161A
2N2270	145B
2N2297	149B
2N2369	132A
2N2369A	132A
2N2484	107B
2N2651	162A
2N2696	212B
2N2710	162A
2N2904	212B
2N2904A	212B
2N2905	212A
2N2905A	212A
2N2906	212B
2N2906A	212B
2N2907	212A
2N2907A	212A
2N2927	212B
2N3013	162A
2N3019	149A
2N3020	149B
2N3072	212B
2N3073	212B
2N3107	149A
2N3108	149B
2N3109	149A
2N3120	212B
2N3133	212B
2N3134	212A
2N3135	212B
2N3136	212A
2N3251	215A
2N3304	292B
2N3439	333A
2N3440	333A
2N3700	149A
2N3701	149B
2N3724	139B
2N3725	139A
2N3903	144B
2N3904	144A
2N3905	215B
2N3906	215A
2N3946	144B
2N3947	144A
2N3962	219B
2N3964	219A
2N4013	139B
2N4014	139A
2N4030	224B
2N4031	224B
2N4032	224A
2N4033	224A
2N4036	224B
2N4037	224B
2N4123	144B
2N4124	144A
2N4125	215B
2N4126	215A
2N4137	132A
2N4208	292B
2N4209	292A
2N4234	414B
2N4235	414B
2N4236	414B
2N4237	314B
2N4238	314B
2N4239	314B
2N4400	145B
2N4401	145A
2N4402	212B
2N4403	212A
2N4409	147A
2N4410	147A
2N4896	340A
2N5042	224B
2N5087	219A
2N5089	155A
2N5209	155B
2N5210	155B
2N5220	145B
2N5223	144A
2N5224	162A
2N5225	145B
2N5226	212B
2N5227	215A
2N5228	292B
2N5270	145B
2N5320	314B
2N5321	314B
2N5322	414B
2N5323	414B
2N5400	232A
2N5401	232A
2N5415	443A
2N5416	443A
2N5550	147A
2N5679	414A
2N5680	414A
2N5681	314A
2N5682	314A
2N5769	132A
2N5771	292A
2N5772	162A
2N5830	147A
2N5831	147A
2N5833	147A
2N5961	107B
2N5962	107A
2N699	149B
2N699B	149B
2N706	162A
2N708	162A
2N720	149B
2N720A	149B
2N744	132A
2N870	149B
2N914	162A
2N916	144B
2N930	107C
2N930A	107C
2N947	162A
2N957	144A

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Die Sales Cross Reference cont.

Transistors

MPS3563	121A
MPS3638	212A
MPS3639	292B
MPS3640	292B
MPS3646	162A
MPS3702	212B
MPS3703	212B
MPS3704	145A
MPS4355	224A
MPS4356	224B
MPS5172	144A
MPS5551	147A
MPS6515	155B
MPS6521	155A
MPS6535	212B
MPS6560	124A
MPS6562	202A
MPS6571	155A
MPS6590	147A
MPS6591	147A
MPS918	121A
MPSA05	150A
MPSA06	150A
MPSA10	144A
MPSA12	164A
MPSA13	164A
MPSA14	164A
MPSA18	107A
MPSA20	144A
MPSA42	176A
MPSA43	176A
MPSA55	224A
MPSA56	224A
MPSA70	215A
MPSA92	276A
MPSA93	276A
MPSL01	147A
MPSL51	232A
PE4002	107B
PE4010	107B
PE4020	107B
PE7058	176A
PE7059	176A
PE8050	124A
PE8052	124A
PE8550	202A
PE8552	202A
PN3565	155B
PN3567	145B
PN3569	145A
PN3638A	212A
PN3643	145A
PN4121	215B
PN4248	219B
PN4249	219B
PN4250	219A
PN4258	292B
PN4274	132A
PN4275	132A
PN4354	224A
PN4355	224A
PN4356	224B
PN4888	232A
PN4889	232A
PN4916	215B
PN4946	145A
PN4965	219B
PN5128	145B
PN5130	121A
PN5133	107B
PN5134	132A
PN5135	145A
PN5136	145B
PN5137	145B
PN5138	219B
PN5139	215B
PN5142	212B
PN5143	212A
PN5770	121A
PN5855	224B
PN5857	224B
PN5965	147A
PN6076	215A

Diodes

1N3064	1225
1N3070	1425
1N3595	1525
1N3600	1225
1N4009	1225
1N4148	1225
1N4149	1225
1N4150	1225
1N4151	1225
1N4154	1225
1N4376	1725
1N4446	1225
1N4447	1225
1N4448	1225
1N4454	1225
1N456A	1525
1N457	1525
1N457A	1525
1N458	1525
1N458A	1525
1N459	1525
1N459A	1525
1N4606	1225
1N482B	1525
1N483B	1525
1N485B	1525
1N493B	1425
1N628	1425
1N659	1225
1N660	1425
1N661	1425
1N914	1225
1N914A	1225
1N914B	1225
1N916	1225
1N916A	1225
1N916B	1225
FDH325	1525
FDH333	1525
FDH425	1425
FDH444	1425
FDH625	1225
FDH666	1225
FD725	1725
FD777	1725
FJT1100	1325
FJT1101	1325

Wafer And Dice Information

Diode Dice Selection Guide

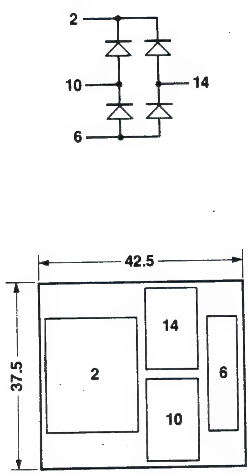
Device	B_V	V_F	I_R	T_{RR}	CAP
1425	100 μA >200 V	100 mA <1.0 V	150 V <100 nA	10 mA <50 ns	C_O < 2.5 pF
1525	100 μA >200 V	100 mA <1.0 V	175 V <25 nA	–	C_O < 5.0 pF
1225	5.0 μA >75 V	100 mA <1.0 V	50 V <100 nA	10 mA <4.0 ns	C_O < 2.5 pF
1725	5.0 μA >20 V	50 mA <1.1 V	10 V <100 nA	10 mA <0.8 ns	C_O < 1.2 pF
1325	5.0 μA >30 V	50 mA <1.1 V	5.0 V <10 pA	–	C_O < 2.0 pF

Diode Array Die Selection Guide

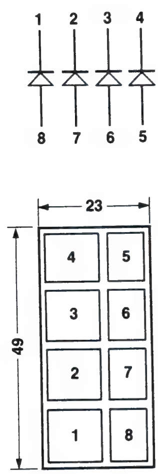
Product*	B_V (Min) @ I_R	I_R (Max) @ V_R	V_F (Max) @ I_F	V_F (Max) @ I_F	T_{RR} (Typ) $I_F = I_R$	CAP (Typ) @ V_R
02MO	60 V 100 μA	100 nA 50 V	1.0 V 100 mA	–	20 nS 200 mA	4.0 pF 0 V
04MO	75 V 5.0 μA	25 nA 20 V	1.0 V 100 mA	–	6.0 ns 10 mA	4.0 pF 0 V
08MO	60 V 10 μA	100 nA 50 V	1.0 V 100 mA	1.5 V 500 mA	20 ns 200 mA	4.0 pF 0 V
16MO	60 V 10 μA	100 nA 50 V	1.0 V 100 mA	1.5 V 500 mA	20 ns 200 mA	4.0 pF 0 V
18MO	60 V 10 μA	100 nA 50 V	1.0 V 100 mA	1.5 V 500 mA	20 ns 200 mA	4.0 pF 0 V
19MO	60 V 10 μA	100 nA 50 V	1.0 V 100 mA	1.5 V 500 mA	20 ns 200 mA	4.0 pF 0 V
28MO	60 V 10 μA	100 nA 50 V	1.0 V 100 mA	1.5 V 500 mA	20 ns 200 mA	4.0 pF 0 V

* Refer to schematic diagrams and topography for chip configuration.

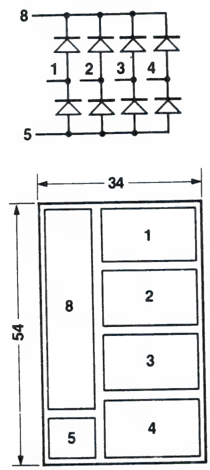
Diode Array Schematics and Topography



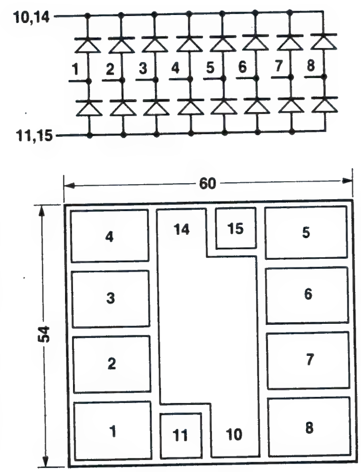
02M0



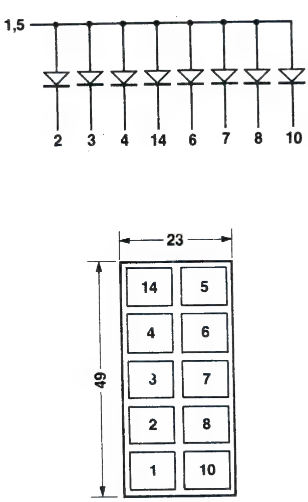
04M0



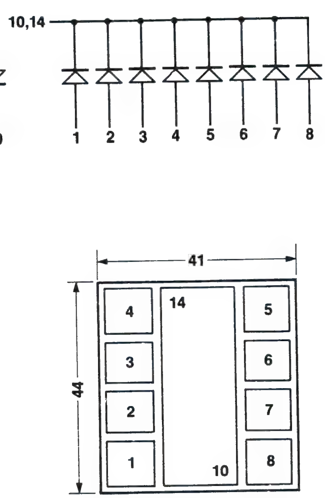
08M0



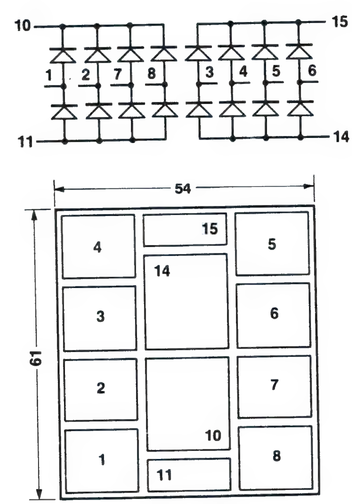
16M0



18M0



19M0



28M0

Die Sales Cross Reference
Diode Arrays

FSA1410	18MO
FSA1411	19MO
FSA2002	19MO
FSA2500	16MO
FSA2501	16MO
FSA2502	16MO
FSA2503	28MO
FSA2504	28MO
FSA2509	28MO
FSA2510	16MO
FSA2563	19MO
FSA2564	18MO
FSA2565	19MO
FSA2566	18MO
FSA2619	04MO
FSA2620	04MO
FSA2621	04MO
FSA2702	02MO
FSA2703	02MO
FSA2704	02MO
FSA2705	04MO
FSA2719	04MO
FSA2721	04MO

Transistor Dice Selection Guide

Product	I_{CES}	I_{EBO}	H_{FE}	H_{FE}	H_{FE}	$V_{CE(S)}$
107A	45 V <10 nA	5.0 V <10 nA	10 μA/5.0 V >450	100 μA/5.0 V 500 - 1200	10 mA/5.0 V 700 - 1400	10 mA/0.5 mA <0.2 V
107B	45 V <10 nA	nA <10 nA	5.0 V 200 - 500	10 μA/5.0 V 225 - 500	100 μA/5.0 V 250 - 700	10 mA/5.0 V <0.2 V
107C	45 V <10 nA	5.0 V <10 nA	10 μA/5.0 V 100 - 300	100 μA/5.0 V 125 - 400	10 mA/5.0 V 200 - 600	10 mA/0.5 mA <0.2 V
121A	25 V <10 nA	3.0 V <10 nA	2.0 mA/6.0 V >75	8.0 mA/10 V >60	8.0 mA/10 V <190	10 mA/1.0 mA <0.2 V
124A	20 V <75 nA	4.0 V <50 nA	10 mA/1.0 V 50 - 180	100 mA/1.0 V 65 - 180	1.0 A/1.0 V 40 - 180	1.0 A/100 mA <0.5 V
132A	20 V <200 nA	4.0 V <500 nA	10 mA/0.35 V >40	10 mA/1.0 V <120	30 mA/0.4 V >30	100 mA/10 mA <0.5 V
139A	60 V <250 nA	4.0 V <250 nA	100 mA/1.0 V >60	100 mA/1.0 V <150	500 mA/1.0 V >35	500 mA/50 mA <0.5 V
139B	40 V <250 nA	4.0 V <250 nA	100 mA/1.0 V >60	100 mA/1.0 V <150	500 mA/1.0 V >35	500 mA/50 mA <0.42 V
144A	40 V <10 nA	5.0 V <10 nA	1.0 mA/1.0 V >90	10 mA/1.0 V 120 - 300	100 mA/1.0 V >30	50 mA/5.0 mA <0.3 V
144B	40 V <10 nA	5.0 V <10 nA	1.0 mA/1.0 V >35	10 mA/1.0 V 50 - 150	100 mA/1.0 V >15	50 mA/5.0 mA <0.3 V
145A	50 V <15 nA	5.0 V <10 nA	100 μA/10 V >40	150 mA/1.0 V >100	150 mA/10 V <300	150 mA/15 mA <0.22 V
145B	50 V <15 nA	5.0 V <10 nA	100 μA/1.0 V >20	150 mA/1.0 V 50 - 120	150 mA/10 V <150	150 mA/15 mA <0.22 V
147A	120 V <50 nA	5.0 V <50 nA	1.0 mA/5.0 V >80	10 mA/5.0 V >80	10 mA/5.0 V <250	50 mA/5.0 mA <0.2 V
149A	80 V <10 nA	5.0 V <10 nA	100 μA/10 V >50	150 mA/10 V >100	150 mA/10 V <300	150 mA/15 mA <0.2 V
149B	80 V <10 nA	5.0 V <10 nA	100 μA/10 V >30	100 μA/10 V <100	150 mA/10 V <120	150 mA/15 mA <0.2 V
150A	60 V <20 nA	5.0 V <10 nA	100 μA/5.0 V >25	100 μA/1.0 V 50 - 300	500 mA/10 V >20	150 mA/15 mA <0.4 V
155A	45 V <10 nA	6.0 V <10 nA	100 μA/5.0 V 400 - 800	1 mA/5.0 V >450	2.0 mA/10 V <800	50 mA/5.0 mA <0.3 V
155B	45 V <10 nA	6.0 V <10 nA	100 μA/5.0 V >100	100 μA/5.0 V <300	2.0 mA/10 V 250 - 300	50 mA/5.0 mA <0.3 V
162A	20 V <50 nA	4.0 V <80 nA	30 mA/0.4 V >40	30 mA/1.0 V <120	100 mA/0.5 V >25	100 mA/10 mA <0.28 V
164A	15 V <100 nA	10 V <50 nA	10 mA/5.0 V >20K	10 mA/5.0 V <100K	100 mA/5.0 V >20K	100 mA/100 μA <1.6 V
176A	200 V <100 nA	6.0 V <50 nA	30 mA/10 V >50	30 mA/10 V <200	150 mA/20 V >15	20 mA/2.0 mA <0.5 V

Wafer And Dice Information

$V_{BE(S)}$	F_T	LV_{CEO}	T_{off}
10 mA/0.5 mA 0.7 V - 0.9 V	>100 MHz	10 mA >60 V	–
10 mA/0.5 mA 0.7 V - 0.9 V	10 mA/0.5 mA	>100 MHz >60 V	10 mA
10 mA/0.5 mA 0.7 V - 0.9 V	>100 MHz	10 mA >60 V	–
10 mA/1.0 mA <0.9 V	>750 MHz	3.0 mA >15 V	–
1.0 A/100 mA <1.2 V	100 MHz	10 mA >25 V	–
10 mA/1.0 mA 0.7 V - 0.9 V	>500 MHz	10 mA >15 V	<18 nS
500 mA/50 mA <1.1 V	>300 MHz	10 mA >50 V	<60 ns
500 mA/50 mA 0.9 V - 1.1 V	>300 MHz	10 mA >40 V	<60 ns
50 mA/5.0 mA <0.9 V	>250 MHz	1.0 mA >40 V	<250 ns
50 mA/5.0 mA <0.9 V	>200 MHz	1.0 mA >40 V	<250 ns
150 mA/15 mA 0.75 V - 0.95 V	>300 MHz	10 mA >40 V	<250 ns
150 mA/15 mA 0.75 V - 0.95 V	>250 MHz	10 mA >50 V	<250 ns
50 mA/5.0 mA <1.0 V	100-300 MHz	10 mA >180 V	–
150 mA/15 mA <0.9 V	>100 MHz	10 mA >80 V	250 - 1000 ns
150 mA/15 mA <0.9 V	>100 MHz	10 mA >80 V	<600 ns
150 mA/15 mA <0.9 V	>100 MHz	10 mA >80 V	–
50 mA/5.0 mA <1.0 V	>300 MHz	1.0 mA >45 V	–
50 mA/5.0 mA <1.0 V	>300 MHz	1.0 mA >50 V	–
100 mA/10 mA <1.2 V	>350 MHz	10 mA >20 V	<25 ns
100 mA/100 μA <1.6 V	>125 MHz	10 mA >30 V	–
20 mA/2.0 mA <0.9 V	>50 MHz	1.0 mA >300 V	–

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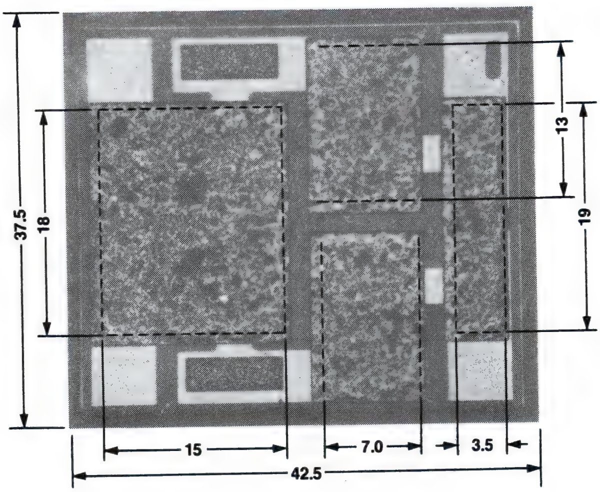
Transistor Dice Selection Guide

Product	I_{CES}	I_{EBO}	H_{FE}	H_{FE}	H_{FE}	$V_{CE(S)}$
202A	20 V <100 nA	4.0 V <100 nA	10 mA/1.0 V >50	100 mA/1.0 V >65	100 mA/1.0 V <200	200 mA/20 mA <0.15 V
212A	50 <35 nA	5.0 V <50 nA	100 μA/1.0 V >75	150 mA/2.0 V >100	150 mA/10 V <300	150 mA/15 mA <0.4 V
212B	50 V <35 nA	5.0 V <50 nA	100 μA/1.0 V >40	150 mA/2.0 V >50	150 mA/10 V <120	150 mA/15 mA <0.4 V
215A	30 V <25 nA	5.2 V <25 nA	100 μA/1.0 V >100	1.0 mA/5.0 V <300	10 mA/1.0 V >120	50 mA/5.0 mA <0.3 V
215B	30 V <25 nA	5.2 V <25 nA	100 μA/1.0 V >40	10 mA/1.0 V >70	10 mA/5.0 V <150	50 mA/5.0 mA <0.3 V
219A	40 V <10 nA	5.0 V <10 nA	10 μA/5.0 V 250 - 500	100 μA/5.0 V 250 - 700	10 mA/5.0 V >250	10 mA/0.5 mA <0.25 V
219B	50 V <10 nA	5.0 V <10 nA	100 μA/5.0 V >100	100 μA/5.0 V <300	500 μA/2.0 V >125	10 mA/0.5 mA <0.2 V
224A	75 V <50 nA	5.0 V <10 nA	100 μA/5.0 V >75	100 mA/1.0 V >100	100 mA/5.0 V <300	150 mA/15 mA <0.15 V
224B	75 V <50 nA	5.0 V <10 nA	1 mA/10 V >40	100 mA/1.0 V >50	100 mA/5.0 V <120	150 mA/15 mA <0.15 V
232A	120 V <50 nA	4.0 V <10 nA	10 mA/5.0 V >70	10 mA/5.0 V <180	50 mA/5.0 V >50	50 mA/5.0 mA <0.25 V
276A	200 V <50 nA	5.0 V <10 nA	1 mA/10 V >30	10 mA/10 V 40 - 400	30 mA/10 V 30 - 150	20 mA/2.0 mA <0.4 V
292A	10 V <10 nA	3.0 V <50 nA	10 mA/0.3 V >50	10 mA/0.3 V <120	50 mA/1.0 V >40	10 mA/1.0 mA <0.18 V
292B	10 V <10 nA	3.0 V <50 nA	10 mA/0.3 V >30	10 mA/3.0 V <120	50 mA/1.0 V >30	10 mA/1.0 mA <0.15 V
314A	120 V <1.0 μA	5.0 V <100 nA	250 mA/2.0 V >40	500 mA/3.0 V >30	500 mA/3.0 V <150	500 mA/50 mA <0.3 V
314B	100 V <100 μA	5.0 V <100 nA	500 mA/4.0 V >40	500 mA/4.0 V <130	1.0 A/1.0 V >15	1.0 A/0.1 A <0.6 V
316A	90 V <10 μA	6.0 V <100 μA	500 mA/2.0 V >30	2.0 A/2.0 V >30	2.0 A/2.0 V <375	2.0 A/0.1 A <0.5 V
333A	450 V <20 μA	6.0 V <20 μA	20 mA/10 V >40	20 mA/10 V <160	100 mA/2.0 V >10	50 mA/4.0 mA <0.5 V
340A	60 V <20 nA	4.0 V <1.0 μA	40 mA/1.0 V >50	2.0 A/2.0 V >100	2.0 A/2.0 V <300	5.0 A/0.5 A <1.0 V
414A	120 V <1 μA	7.0 V <1.0 μA	250 mA/2.0 V >40	250 mA/2.0 V <150	1.0 A/2.0 V >15	1.0 A/0.1 A <1.0 V
414B	100 V <100 μA	6.0 V <10 μA	10 mA/4.0 V >40	250 mA/1.0 V 30 - 150	500 mA/4.0 V 40 - 130	1.0 A/0.125 A <0.6 V
443A	300 V <50 μA	4.0 V <500 nA	5.0 mA/10 V >25	50 mA/10 V >30	50 mA/10 V <120	50 mA/5.0 mA <1.4 V

$V_{BE(S)}$	F_T	LV_{CEO}	T_{off}
200 mA/20 mA <0.9 V	>100 MHz	10 mA >25 V	–
150 mA/15 mA <0.95 V	>250 MHz	10 mA >60 V	<100 ns
150 mA/15 mA <0.4 V	>200 MHz	10 mA >60 V	<100 ns
50 mA/5.0 mA <0.95 V	>450 MHz	10 mA >45 V	<325 ns
50 mA/5.0 mA <0.95 V	>450 MHz	10 mA >45 V	<300 ns
10 mA/0.5 mA <0.9 V	>50 MHz	5.0 mA >50 V	–
100 mA/0.5 mA <0.9 V	>40 MHz	>60 V	–
150 mA/15 mA 0.95 V	150 - 500 MHz	5.0 mA >80 V	<400 ns
150 mA/15 mA 0.95 V	150 - 500 MHz	10 mA >80 V	<400 ns
50 mA/5.0 mA <1.0 V	>100 MHz	1.0 mA >150 V	–
20 mA/2.0 mA 0.9 V	>50 MHz	10 mA >300 V	–
10 mA/1.0 mA 0.95 V	>850 MHz	3.0 mA >15 V	<20 ns
10 mA/1.0 mA <0.95 V	>900 MHz	3.0 mA >12 V	<20 ns
500 mA/50 mA <1.2 V	>40 MHz	10 mA >60 V120 V	–
1.0 A/0.1 A <1.5 V	>50 MHz	30 mA >80 V	<800 ns
2.0 A/0.1 A <1.5 V	>30 MHz	50 mA >75 V	<10 μs
50 mA/4.0 mA <1.3 V	>15 MHz	15 mA >350 V	–
5.0 A/0.5 A <1.6 V	>80 MHz	50 mA >60 V	–
1.0 A/0.2 A <1.2 V	>30 MHz	10 mA >120 V	–
1.0 A/0.1 A <1.5 V	>50 MHz	10 mA >80 V	<1000 ns
50 mA/5.0 mA <1.5 V	>15 MHz	5.0 mA >350 V	–

Wafer And Dice Information

02MO DIE



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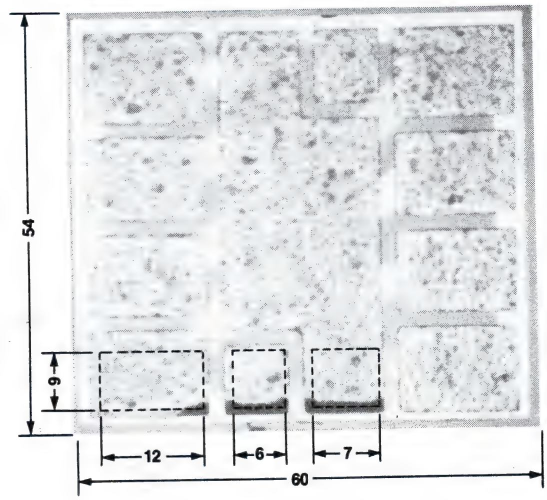

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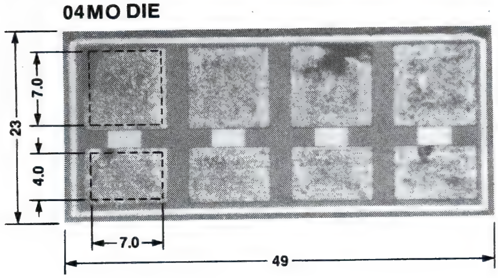

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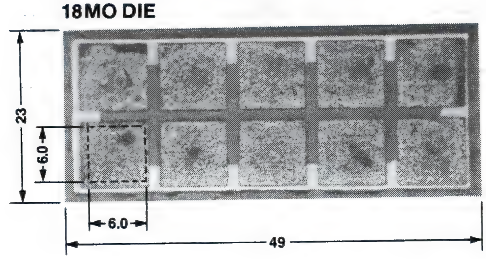

Wafer And Dice Information

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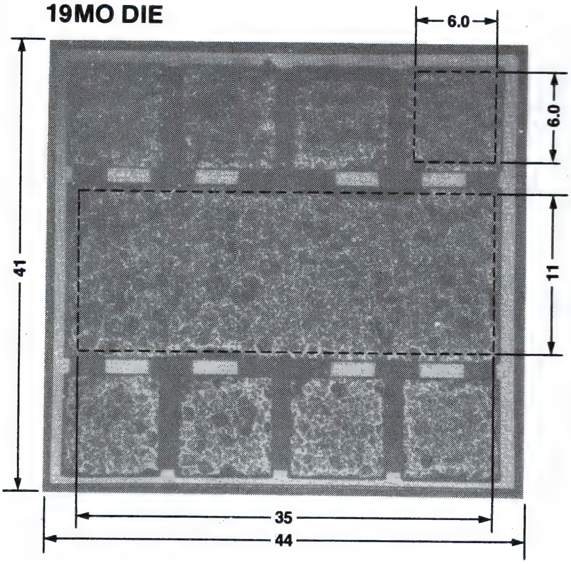

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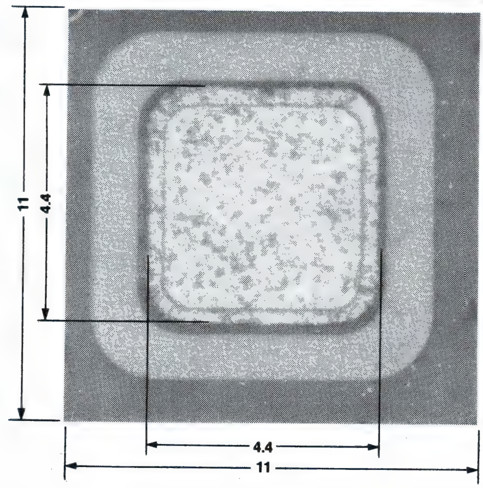

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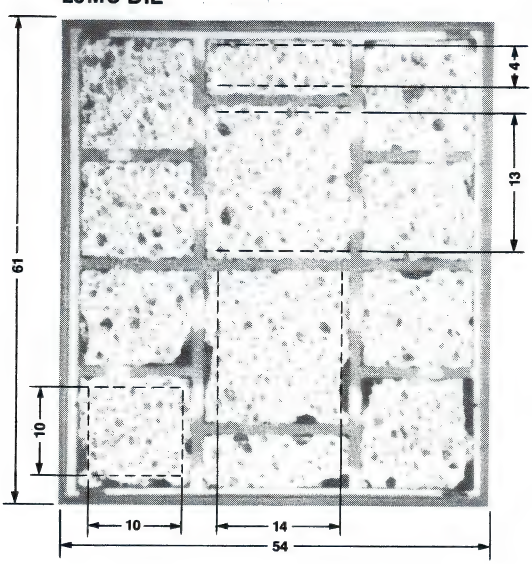

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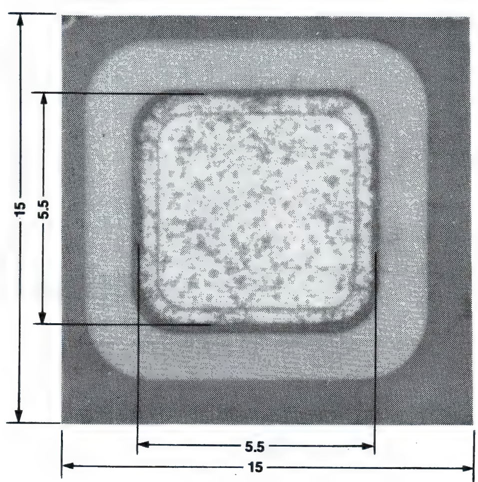

8

Wafer And Dice Information

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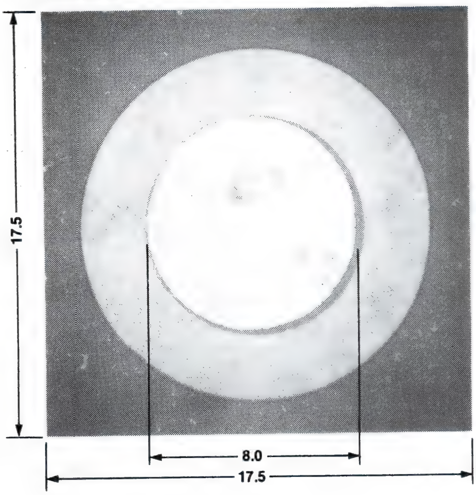

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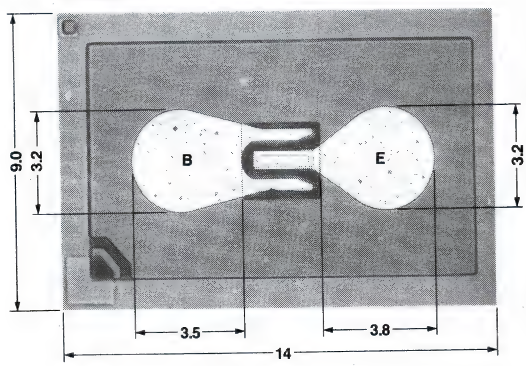
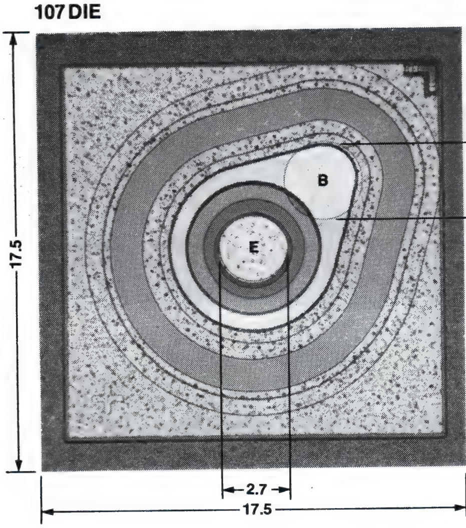


107 DIE



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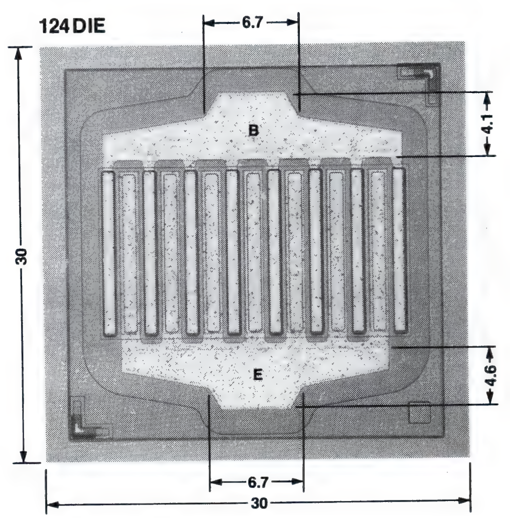

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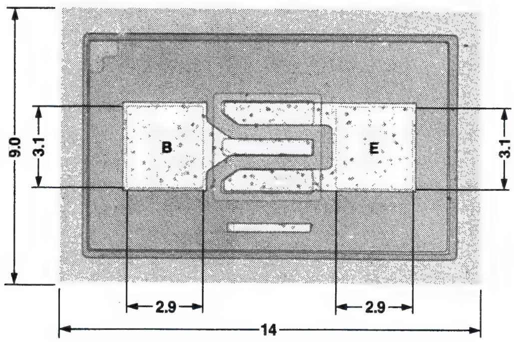

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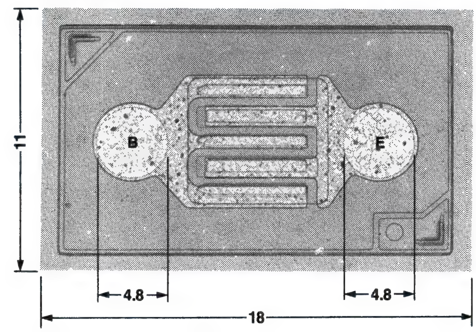

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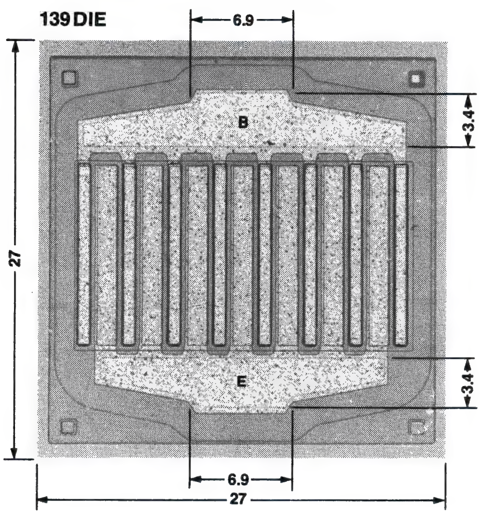

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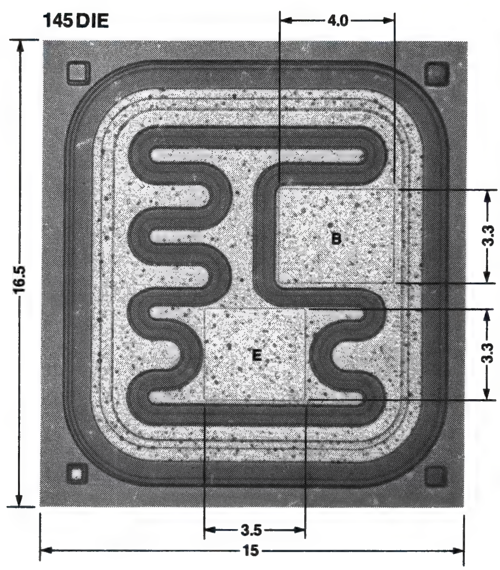

Wafer And Dice Information

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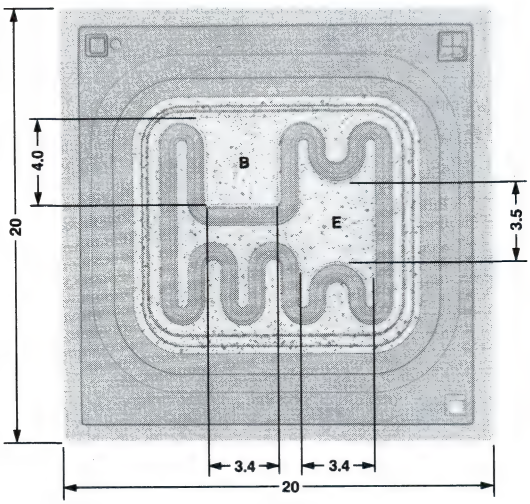

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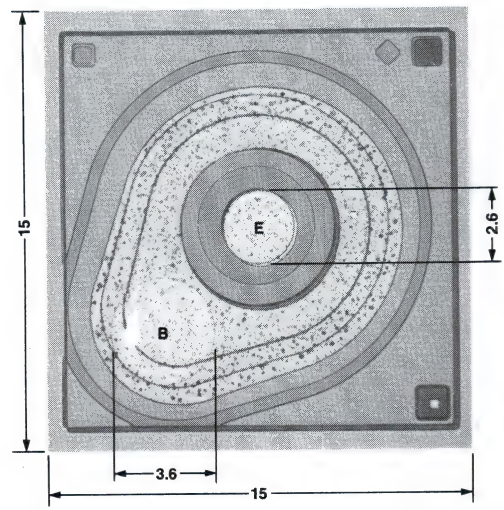

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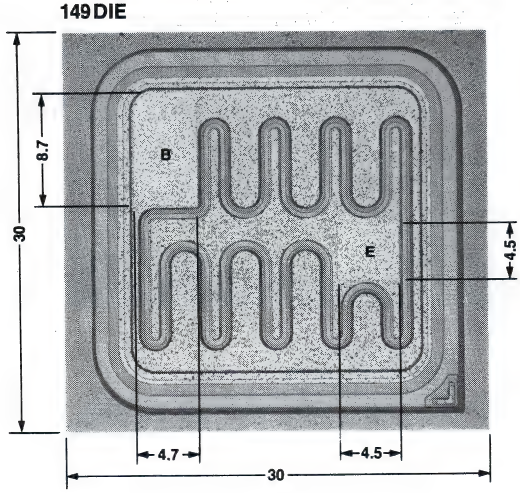

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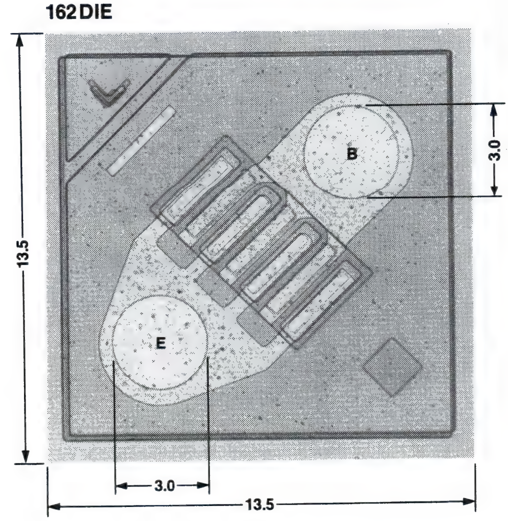

Wafer And Dice Information

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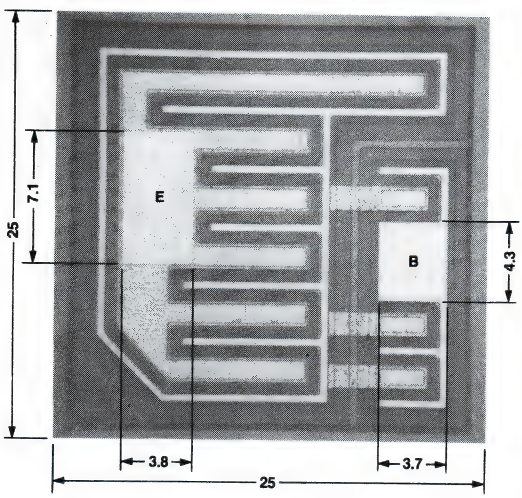

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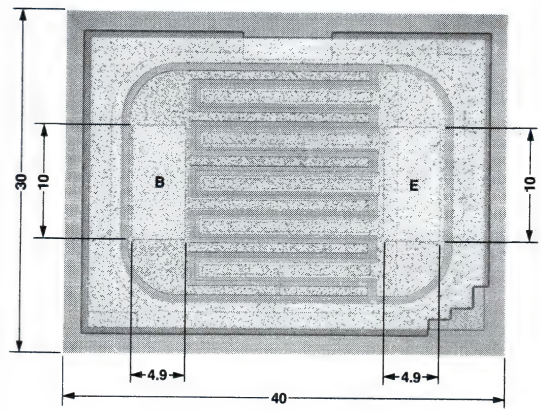

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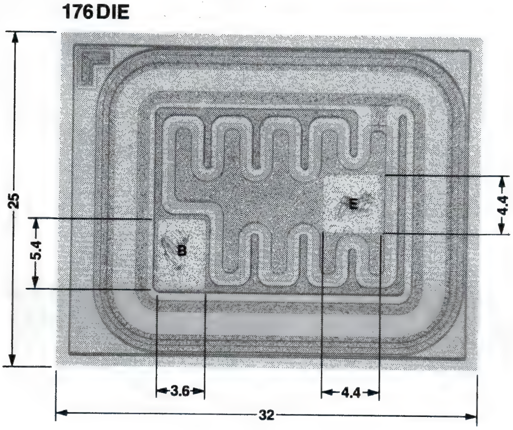

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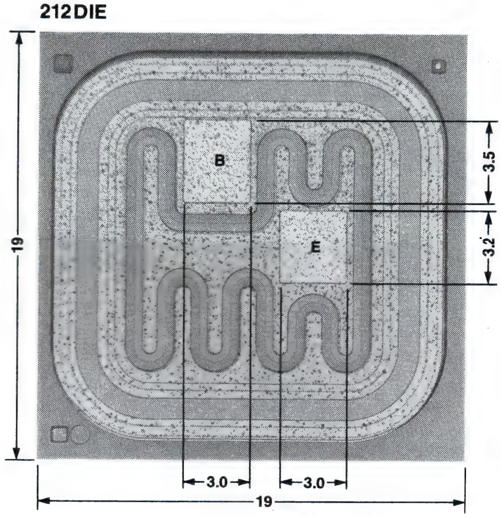

8

Wafer And Dice Information

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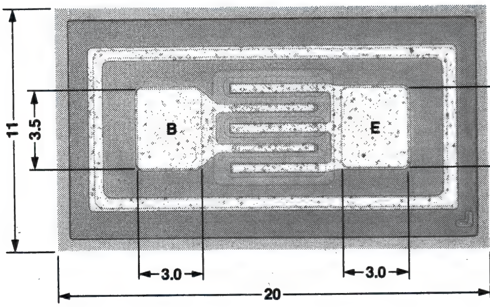

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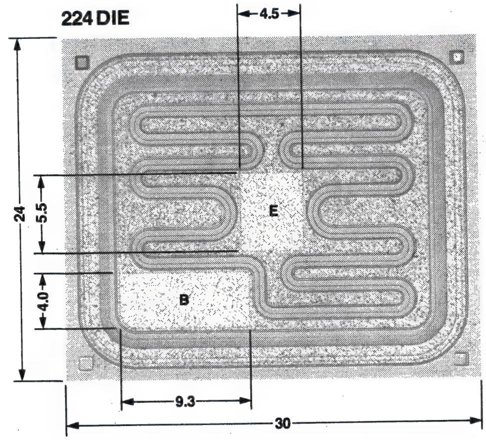

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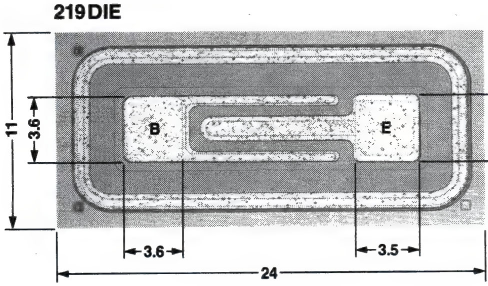

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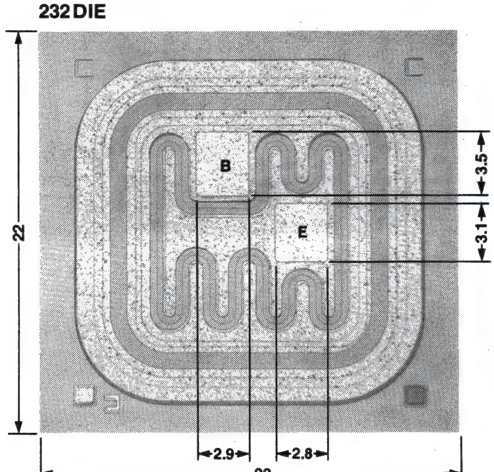

Wafer And Dice Information

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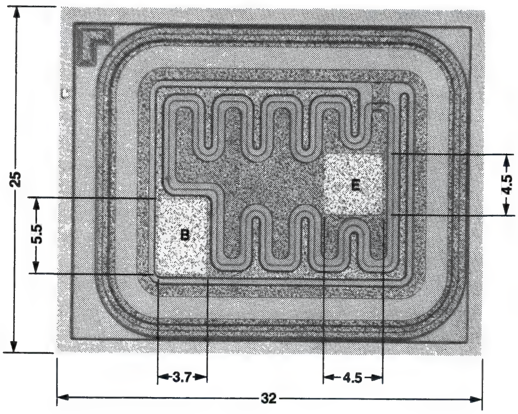

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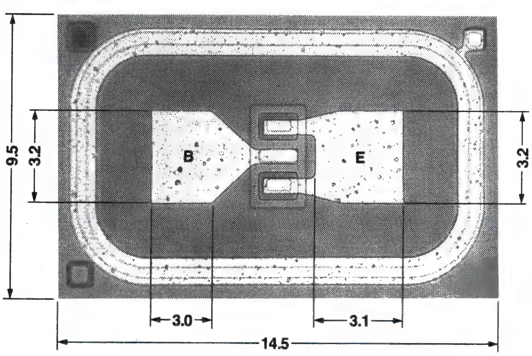

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